

USE OF GROWTH CHARTS FOR PROMOTING CHILD NUTRITION

A Review of Global Experience

By
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and
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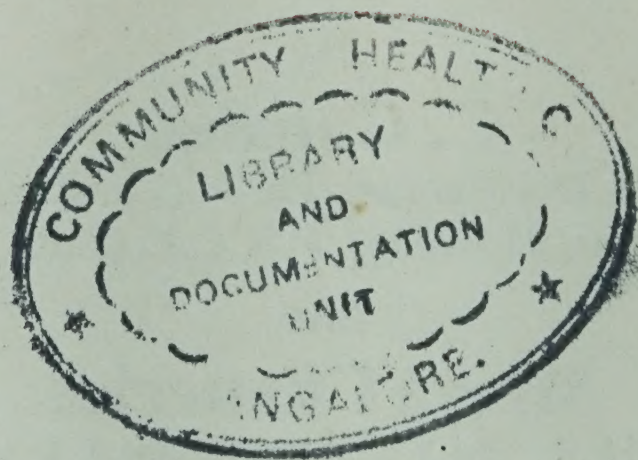
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Foreword

Growth retardation is an important and quantifiable manifestation of undernutrition. Measurement of growth has, therefore, always been considered a valuable tool for the assessment of the nutritional status of children. For this reason, anthropometry has traditionally enjoyed an important place in nutrition surveys of populations.

Extensive cross-sectional studies of the growth status of children have been undertaken in developed countries (notably the U.S.A. and the U.K.), and have resulted in the elaboration of widely used international "reference standards" of growth. Similar studies have been undertaken in some developing countries to determine local growth patterns, identify undernourished communities, and to assess changes in nutritional status over a period of time. The nation-wide study on growth and development of Indian children organised by the Indian Council Of Medical Research in the '50s, under the leadership of the National Institute of Nutrition (then the Nutrition Research Laboratories) is a classical example of a major cross-sectional growth study from a developing country. The National Nutrition Monitoring Bureau, affiliated to the National Institute of Nutrition, has been conducting annual, large-scale, anthropometric, dietary and nutritional studies of population groups in several states of the Indian Union, for well over a decade now.

Starting with the well-known proposal of Gomez, individual growth measurements of children are being widely used to assess their *grade* of undernutrition. Several other systems of "classifications" of undernutrition, and a few "refinements" of the original Gomez scale have also been proposed.

Although nutritional anthropometry and growth-monitoring are themselves not new developments, attempts to promote the use of growth charts for the purpose of individual surveillance of under-fives in developing countries as an essential and routine primary health care operation at the village and home levels in developing countries are relatively new. International agencies apparently recognise that the implications of a strategy to build "growth-monitoring" into Primary Health Care Systems requires careful examination. Fortunately, considerable global experience of the use of growth charts has now accumulated, which has enabled us to undertake such examination.

Several expert groups have met under the auspices of WHO from time to time to consider different aspects of nutritional anthropometry and growth-monitoring and have offered useful recommendations. Earlier in the year, WHO enlisted my services as a consultant to review the recent global experience in the utilisation of "growth charts as a tool for improving nutrition status of children" Emphasis was requested on:

- 1) the options utilised after growth is measured;
- 2) the evaluation of changes in maternal attitudes or child-rearing practices brought about;
- 3) operational constraints; and
- 4) training and educational issues.

A report in fulfilment of this assignment was prepared and submitted by me to WHO on the basis of:

(a) A report by Dr. Meera Chatterjee who, in response to my request, visited different project sites in India where growth-monitoring operations are in progress, in order to obtain first-hand information and observations. Dr. Chatterjee also gave me valuable help in assembling published literature and in the drafting of this report.

(b) A report of a valuable study carried out by Dr. Tara Gopaldas at my request on the use of growth charts in a rural area of Gujarat state; and

(c) Extensive consultations with leading scientists conversant with the subject, in different countries (Appendix 1) and careful scrutiny of published and unpublished (restricted circulation) reports (References), and

(d) Proceedings of a "consultation meeting" held at New Delhi, India, in which the first-hand experience of front-line workers in India with growth-monitoring and use of growth charts were discussed (Appendix 2).

I am deeply grateful to the scientists all over the world who have kindly given their most valuable help, views and suggestions. Their names have been indicated elsewhere (Appendix 1).

I deeply appreciate the genuine interest shown by Dr. H. Mahler, Director-General, WHO, and Dr. Angela Petros-Barvazian. I thank them and the WHO for this opportunity to report on a subject of great practical importance for child health and nutrition in developing countries.

The present publication is largely based on the report earlier submitted to WHO. I am glad that Dr. Meera Chatterjee, who gave me valuable assistance in the preparation of that report, has joined me as a co-author of this publication. This is being published with the permission of WHO, but the views expressed herein need not be considered as necessarily reflecting those of WHO.

C. Gopalan

Preface

Recently, there have been many valuable publications on growth-monitoring and growth charts. This report does not claim to be an exhaustive review of the subject of growth-monitoring. Its emphasis is on an examination of the operational problems involved in the use of growth charts in developing countries and on an assessment of the place of growth-monitoring in Primary Health Care operations in these countries in the light of available experience.

The report is presented in six main sections. A brief summary is included for the reader's convenience. The first section contains a brief introductory review of nutritional anthropometry and growth charts. It also outlines the objectives of the present report and the study design. The second section deals with the practical and logistic problems encountered in the conduct of growth-monitoring operations using growth charts; the third examines the question of how growth charts are being interpreted and utilised to promote child health and nutrition; the fourth considers the training and educational aspects of the use of growth charts. The fifth section reviews the reports of evaluations of growth-monitoring programmes using growth charts and the sixth deals with the important question of the place of growth-monitoring using growth charts in the Primary Health Care Systems of developing countries.

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1. Introduction

1.1. NUTRITIONAL ANTHROPOMETRY AND GROWTH CHARTS—A BRIEF REVIEW OF CURRENT STATUS

The process of normal growth and development is dependent on an adequate and timely supply of essential nutrients. Undernutrition, in which there is a deficiency of essential nutrients needed for growth, will be reflected in impairment of growth. The growth status of a child is, therefore, a useful indicator of its nutritional status. However, growth measurement, as an indicator of the severity of undernutrition, is not without its limitations. These limitations will be referred to later in this report. Despite these limitations, measurement of growth is undoubtedly a most convenient and practical tool in the hands of health workers for the identification of undernutrition and for the evaluation of the child's response to remedial measures. However, this will be the case only if the tool is used with full knowledge and appreciation of its limitations.

Nutritional anthropometry: It is possible to use a variety of anthropometric measures to assess child growth. Among the most studied are: weight, height, arm circumference, skin-fold thickness, chest circumference, and head circumference.

Weight is a measure of total body mass, and hence is sensitive to changes in body fluids, fat, muscle mass, the skeleton, and other organs. Arm circumference assesses the degree of muscle and fat (around the bone) in the mid upper-arm area. Skin-fold thickness is an indication of body fat reserves. Height is a measure of the linear growth of the body—the degree of skeletal development. While weight and arm circumference are affected within a short

duration of inadequate nutrient intake and ill-health, height, head and chest circumference do not change so rapidly; nor can these latter decrease in acute nutritional deficiency. Relatively speaking, therefore, weight and arm circumference can be considered "sensitive" indicators of nutritional status, responsive to (acute) nutritional deficiency of short duration, while height deficits may be considered to be indicative of chronic nutritional deprivation.

There has been much discussion on which of these measures is most appropriate in different populations, at different times, or diagnostic of different nutritional situations. Generally, weight, height and arm circumference have come to be considered the most sensitive parameters of under-five nutritional status, and most practical for the monitoring of individual children, or of a population of children. When related to his age, weight and height provide the means to study a child over a period of time. Arm circumference, which does not change very significantly between the ages of one and five years, and weight-for-height, provide age-independent measures, and so are useful when age is difficult to estimate, or unknown. Combinations of these measurements have been suggested, sometimes to distinguish "types" of malnutrition (1). For example, Waterlow proposed that weight/height allows one to distinguish between children who have suffered malnutrition in the past from those who are currently experiencing malnutrition. When malnutrition has been chronic, the child is "stunted"—both his weight-for-age and height-for-age are low, but his weight-for-height may be normal. In acute malnutrition, however, his height-for-age is appropriate, but he is "wasted" or of low weight for both height and age. Thus, weight and height measurements together are useful to understand the dynamics of malnutrition, distinguishing between current malnutrition and long-term or chronic malnutrition (2). Visweswara Rao has argued persuasively that these measures are adequate for assessing nutritional status and that not much is gained by additional forms of measurement (3).

Reference standards: A child's growth data are usually compared with that of a "reference" population to facilitate evaluation of his nutritional status. The question of which population provides the most relevant "reference" for groups of undernourished children in developing countries has engendered much debate. The observation that well-nourished children in developing countries grow in much the same way as their counterparts in the developed world, has lent support to the use of a single international growth standard for all (4),(5). The underlying assumption is that all children have the same genetic potential especially in the early years of life and their growth is more strongly influenced by environmental factors such as nutrition than by heredity (6).

The most frequently used reference standards are derived from studies of growth in healthy children from the U.S. and the U.K. The "Harvard Standards" of weight-for-age and height-for-age were obtained by a study of well-nourished Caucasian children in Boston in the 1930s (7) and have been used extensively throughout the world. Weights-for-height have also been calculated from these data. Reference data were also collected on British children (8) and these have been used in the development of the "Road-to-Health" card. More recently, the (U.S.) National Centre for Health Statistics (NCHS) has collected data on weight, height, arm circumference, skin-fold thickness, and head circumference on a large, economically and ethnically heterogeneous U.S. child population (9). Despite the heterogeneous population used to derive the NCHS data, compared with the homogeneity of the Boston and British groups, the previous standards have been lowered only minimally. The NCHS reference data are now recommended for use by WHO (9).

On the other hand, some investigators have argued that the use of a reference standard derived from a developed country population, or even from well-nourished groups in developing countries, sets impossibly high "standards" (10). It has been proposed that developing countries should evolve their own reference standards (perhaps even sub-regional ones) in order to be more "realistic" about potential growth achievements of their child populations (11), (12).

However, if the object is to assess the true magnitude of growth retardation and undernutrition in a country or community, that purpose will be defeated by deliberately adopting a lower "standard" which does not reflect the full genetic potential for growth and development of children in the country. Now that there is good evidence from studies from different parts of the world that ethnic differences in growth are minimal, the case for the use of a common international reference standard will appear to be strong. In any case, in practice, collection of data to derive local reference standards is a difficult, time-consuming and expensive undertaking and few countries have done so (13). Furthermore, the use of local standards is complicated by the fact that improvement in nutrition in the country will change the "standard" itself. The U.S. and U.K. standards were derived from data in populations which were no longer subject to drastic change, and so most countries continue to use these international reference standards, sometimes with local adaptations or qualifications.

In any population, there is a wide range of "normal" heights and weights at all ages. Thus, the reference data can be expressed in a number of ways: (1) by

the use of mean or median and standard deviation values; (2) by calculating percentages of the median value (which is assigned a value of 100 percent); and (3) by percentiles (centiles) of the reference data where the median value is the 50th percentile. These procedures are frequently used to demarcate levels or grades in nutritional status. The second method is the basis of the widely-used Gomez classification of malnutrition (14). Gomez *et al* proposed that weight-for-age values between 90 and 75 percent of the median value of the Harvard standard be considered equivalent to mild (or Grade I) malnutrition; 75 and 60 percent moderate or Grade II; and below 60 percent, severe or Grade III. Some variations of this classification have been suggested, such as the one by Jelliffe: normal equivalent to 110 and 90 percent of the median; mild or Grade I malnutrition between 90 and 81 percent; moderate Grade II and III, between 80 and 61 percent; and severe or Grade IV below 60 percent. (15). These two systems of classification use the same criteria for "normal" children (above 90 percent of the standard) and for severely malnourished children (below 60 percent of the standard). In India, the Indian Academy of Pediatrics suggested that the limit of "normal" be lowered to 80 percent; that Grade I be set between 80 and 70 percent, Grade II between 70 and 60 percent and Grade III below 60 percent. In addition, Grade IV, below 50 percent, was also included (16).

Roughly speaking, values below 75 percent of the Harvard median, which fall into Grade 2 or below of the Gomez classification, also lie below the third percentile in this same data set. This provides for easy conversion between the second and third methods of expressing growth data. However, the percentile system is now favoured in connection with the use of growth charts (17, 18). The first method, employing standard deviations, is usually only advocated for use when analysing large-scale growth-monitoring and survey data (18). Normal growth is considered to encompass values within two standard deviations of the median. This also roughly approximates the third percentile in weight-for-age reference data. Similar approaches have been used by a number of investigators to evaluate height-for-age (19) and weight-for-height data (20).

Generally, the point of demarcation or "cut-off" point determines the extent of malnutrition in a study population. For example, the prevalence of severe malnutrition will vary according to whether a level of 60 or 50 percent of the median is chosen to demarcate it (i.e. to whether the lowest grade of the Gomez or IAP classifications is used). It must be stressed that the choice of cut-off point is largely arbitrary and implies a value judgement. The common cut-off points or grades do not in themselves have physiological significance (21). Often, the choice depends on the objectives of the nutritional assessment. Indeed, there is sometimes a tendency to lower cut-off points in order to reduce levels of

malnutrition. Much malnutrition can be “wiped out” on paper by a “redefinition of parameters”!

Individual surveillance: Besides describing the nutritional status of a population, growth data are being used increasingly for individual surveillance — to identify and monitor children with growth retardation. In a programme situation, such identification allows selection of beneficiaries or a target group for interventions, the setting of programme goals, and monitoring of effectiveness of the interventions used. Children are usually “graded” according to the degree of their growth retardation observed at a given point of time and their progress to higher levels of nutrition is monitored. Frequently, only the severely malnourished are singled out for intervention, primarily because of the higher mortality risk associated with severe malnutrition than with mild or moderate forms.

Studies in Bangladesh found that severely malnourished children had a four-fold greater risk of mortality compared with mildly moderately malnourished children (22). Although several anthropometric measures were good predictors of mortality over a short period, weight-for-age was most accurate in identifying children at risk of death over a two-year period. Arm circumference was also a reliable measure. Although mortality was highest in the period from zero to three years, the reliability of weight-for-age as an indicator of mortality risk extended up to five years of age. Other studies in India have borne out this relationship between mortality and severe malnutrition based on weight-for-age measurements (23), (24).

Thus, programmes aimed at “child survival”, such as the World Bank-assisted Tamil Nadu Integrated Nutrition Project in India, may target their benefits to severely malnourished children to decrease their high mortality risk. However, two points need to be stressed in this regard. First, that the concept of risk is based on the probability of an event in a *population* and so the grading of a child as severe or not, at any given time, does not have infallible prognostic value *for that particular child*. Second, that children who are severely malnourished at any point of time have earlier been only mildly and moderately malnourished and their return to normalcy from those states would have been far less costly in economic and psychological terms if action was not delayed till they reached the severe stage. Thus, this strategy requires careful reassessment.

The growth chart: While the reliability of a single anthropometric measurement may be suspect and difficult to interpret because of existing wide

variations in any population, and may lack adequate predictive value, repeated measurements at regular intervals permit systematic assessment of a child's growth. The idea that monitoring the growth of the individual child on a long-term basis would be useful in the provision of child health care gave rise to the "growth chart", pioneered by Morley, as a result of a long-term study of child growth in Imesi, Nigeria (25). The growth chart is predicated on the simple principle of regular monthly weighing of the child under five. The child's weight is plotted every month against his or her age, giving a "weight-for-age" graph.

In the early childhood years, growth is rapid and any deviation from "normal" can be detected easily. The longitudinal weight record is thus intended for early detection of malnutrition. For this reason the growth chart commonly uses weight and not height measurements. The weight-for-age curve is regarded as most "dynamic" and sensitive to change. A slowing in the rate of growth indicated by height would take six months to manifest itself while a slowing of weight gain — or weight loss — can be demonstrated within a month. A child can lose weight but not height, and weight is easier to measure. Thus while a single weight measurement indicates a child's status at a given point in time, serial measurements can differentiate a steady state, an upswing or a decline in weight, and consequently in nutritional status.

The growth chart incorporates in it a reference growth trajectory, allowing comparison of a child's growth curve with that of the reference population. A growth disturbance is noted by comparing the gradient or slope of the child's growth curve over two or more measurements with that of the reference lines drawn on the chart. (The child's own earlier growth trajectory is also informative.) This is the Road-to-Health concept envisioned by Morley. In the chart originally conceived by him, the reference lines drawn were the third and 50th centiles of the data collected on British children, which marked out the limits of "normality" of that reference population. (The median for rural children in most developing countries usually falls just above the third centile.) The chart was standardised for use with both sexes by employing the third centile of data on girls as the lower limit and the 50th centile of boys as the upper reference line. Since then there has been a proliferation of charts, using various reference curves, cut-off points and so on. The WHO aimed to put order in this confusion by producing a chart based on the Morley chart, but which uses the NCHS standard (18).

The reference weight curves used, it must be remembered, are derived from cross-sectional data on weights at different ages, and so the evaluation of an individual's weight pattern against them must be done with caution. Morley

stresses that the reference lines are intended to illustrate the direction in which a child's growth curve should travel, i.e. providing a way of comparing the child's growth path with good growth (25). He asserts that the actual reference lines are less important than their shape. The corollary of this is that the child's actual position on the growth chart (i.e. weight at any age) may be misleading, and is not as important to the assessment of his nutritional status as the velocity of his weight gain. As long as the child's weight gain is parallel to the reference line, he is gaining weight at the appropriate rate and is not in need of immediate attention. A growth curve that is flat or decreasing (i.e. has zero or negative slope) is a warning signal. Morley cautions that "too much emphasis is often placed on a child's weight relative to the standard", that decisions are erroneously made on the basis of one weight measurement, and that one of the most difficult points to teach health workers is the importance of the child's curve going parallel to the reference lines on the chart (17). Reference to the growth curve permits early detection whereas noting a deviation only by comparing a child's weight measurement with the desired mean and standard deviations would require the child to be grossly abnormal before detection — and defeat the prime purpose of growth-monitoring which is early detection of growth faltering.

A further sophistication in the interpretation of information on growth charts arose with the "weight gain" concept which was originally conceived as an index of recovery from malnutrition (26). More recently, the criterion of low or 'no weight gain' is being used as a basis on which to select children for health and nutrition interventions: adequate weight gain is associated with their recovery and, hence, a criterion for "graduation" from the programme. A "field trial" comparing the utility of this method with that of the conventional method of selection based on grade is currently on-going in the Tamil Nadu Integrated Nutrition Project (27).

Morley has distinguished between "preventive" growth charts which are useful in developing countries to encourage adequate growth among all children and "curative" charts which are used in developed countries to monitor children with growth dysfunction (28). The former are expected to be understood and used by health workers with limited training while the latter are used and kept by pediatricians and are more complex because they use the decimal system to record age (rather than a "calendar") and require more sophisticated equipment. Weight is the preferred measurement for preventing malnutrition, while height is monitored to manage growth disorders in well-nourished populations. However, the "curative" charts may be used for research in developing countries.

Besides the home-based growth chart, the WHO has also devised a "service" chart for use at health centres (18). This chart has separate standards for each sex, uses five reference lines based on percentiles and standard deviations, and also incorporates a height graph. It is intended for the collation of group data on nutritional status for analytical purposes.

In addition to identifying malnutrition in children and monitoring their growth, growth charts can be used to assess the effectiveness of nutrition interventions by monitoring return to normal growth patterns in individuals. This, too, is made possible by the serial nature of weight measurements recorded on the chart. Increases in weight-for-age are a measure of the "success" of programmes to improve nutritional status, although it has been argued that weight-for-height may be a more suitable indicator for evaluation (29). This is primarily because stunted children tend to be included in low weight-for-age groups and graduate out of that category more slowly, although they may be recovering adequately from "wasting".

In 1974, the Philippines launched a nation-wide campaign to weigh pre-school children in villages, accompanied by mass education. "Operation Timbang" measured the extent of malnutrition in the country, located families with malnourished children, and created nutrition awareness. Subsequently weighing of pre-school children has become an annual activity in the country. The distribution of second and third degree malnutrition is the basis for targetting nutrition programmes to different areas, and for evaluating programme impact. The proliferation of nutrition activities following the launching of this nation-wide programme has led to the large number of different charts available in the country, according to Solon (30). Such a situation may render national nutrition surveillance difficult.

Thus, while the growth chart is primarily an individual record, the information it provides can be used to assess the nutritional status of a population, to target and to evaluate the impact of a programme in both the individual and the group at large.

The child health card: Because of the intimate relationship between nutrition and health, particularly in the child under five, the monthly weight gain is considered a sensitive index of overall child health. Growth faltering is a sign of ill-health and calls for attention both to nutrition and to the possibility of infections. Thus, the growth chart provides a tool to assess morbidity in the child

and a basis for providing integrated nutrition and health care services to young children. Indeed, the regular weighing of children is beginning to be considered a central component of child health care programmes, an approach which is emphasised, for example, in UNICEF's inclusion of growth-monitoring in "GOBI", the four-pronged strategy advocated to improve "child survival". It is thought that health workers can learn to identify children in whom growth is faltering and to provide them with adequate care. As an "objective" tool, a growth chart provides a visual record of the child's health for the first five or six years, and can be interpreted and used by different levels of workers in the health system in a standard way to give the child continuous and comprehensive health care.

The diagnostic value of the growth chart lies in the relationship of growth to illness. Illness may be acute or chronic, resulting in a sudden loss of weight or a slowing of weight gain (i.e. a flattening of the weight curve). The former most likely accompanies an acute episode of illness (e.g. diarrhoea) which *precedes* the loss of weight. The illness may be over before the health worker detects the weight loss, and thus acute weight loss may not be preventable in itself. In this case, the health worker, on enquiry, notes the nature of illness, examines the child's status at the time of weighing and undertakes the responsibility to prevent further weight loss and ensure weight gain. In a chronic illness, or one with a slow onset (such as tuberculosis), a faltering of weight may occur before the disease is clinically manifest. Included in this category may be acute infections with complicated sequelae (such as measles frequently followed by broncho-pneumonias) which result in gradual weight loss over weeks or months. In older children, especially, degeneration into third and fourth degree malnutrition is often preceded by months of failure to thrive (except when acute illness has been especially severe such as is sometimes seen in children who become marasmic rapidly after experiencing third degree burns because of the resultant infection and severe anorexia). In chronic cases, loss of weight should be easier to control. These subtle differences stress the need to teach health workers the importance of the change in slope of the child's weight curve.

To aid in diagnosis and treatment, the growth chart (weight-for-age graph) is usually incorporated into a "child health card" which contains additional information about the child and his health status.

The "Road-to-Health" card designed by Morley is used widely as a prototype. To begin with, there is information to identify the child — his date of birth, sex, parents' names, their occupation, place of residence, and so on. There may be information on the child's family, particularly the names, ages and sexes

of siblings, and the parents' family planning status. There is usually space to record any "risk" indicators for the child, and immunisations and other prophylactic measures (such as Vitamin A, iron-folate supplements, anti-malarials or deworming tablets) received by him. There may be space to list episodes of illness, their duration and treatments given or suggested, and their outcomes. In some cards, there may be an area to record breast-feeding, the kind of food being given to the child, and feeding advice given. The latter may also be provided in the form of instructions or illustrations. All this information gives the card a value beyond that of the weight chart alone, enhancing its "promotive", "preventive" and "curative" uses.

A WHO study of 55 cards from developing countries showed that immunisation and diet information was most commonly included (18). Weight-for-age was the preferred growth measurement. Both local and international standards were used to draw reference lines, and "percentage deficit" was the most common way of expressing inadequate nutritional status. Most charts covered the period from zero to five years and about half the charts had separate standards for girls and boys. Within countries, as well, many different charts and cards may be in use. Recently Tremlett *et al* (31) examined 280 cards from 80 different countries. There were 49 different cards from India alone and 13 each from Indonesia and Nigeria. Solon reports several in the Philippines (30). Tremlett *et al* have analysed various characteristics of the cards such as material used, size, colour, printing and so on, and isolated those which they consider most effective. Their recommendations and those of others will be reviewed in a later section.

In sum, the growth chart, intended primarily as a preventive health tool in developing countries, has many potential uses. Firstly, it provides a way to assess the growth and physical development of children. It is a *diagnostic* tool for health workers to identify malnourished children and monitor them on a continuous basis to prevent further morbidity and mortality. It can also be used as a referral document for primary or secondary care elsewhere. Secondly, it can be used to *select* children who are at risk of morbidity and mortality for nutritional and medical interventions such as supplementary feeding. Thus, in a programme, it can be used to direct resources to the most needy for as long as necessary. It has been called a "problem-oriented record". Thirdly, growth charts provide a good method to *evaluate* the impact of a programme or of specific interventions for improving child health and growth. They are frequently used as the basis for preparing a "nutritional profile" of a population or region. Nutritional information and evaluation results can be the basis of programme and strategy formulation, policy and planning. Fourthly, the chart can be an *educational* tool. It can be used to educate *health workers* from pediatricians to village-level

personnel. They can learn what is normal or abnormal growth, which children are at risk, which need special care, what preventive measures are helpful, and what the inter-relationships are between growth and breast-feeding, diet, disease, birth-spacing, immunisation, and so on. They can observe closely the outcome of their efforts with a child or a community. It is also a way to demonstrate to, and instruct, *mothers*, family or community members on the importance of nutrition and growth to child health and survival, and to motivate them to improve nutrition and health practices that affect their children.

Alternative methods of growth-monitoring: "Growth charting" based on weight-for-age measurements is only one method of growth-monitoring. Other indicators such as height-for-age, weight-for-height, and arm circumference are increasingly being proposed for growth-monitoring (32). The last two are particularly useful when age is not known and they may be more appropriate for rapid screening of malnourished children.

As mentioned earlier, height measurements lack sensitivity to acute malnutrition and so are inadequate by themselves to establish current nutritional status. However, height data may be useful when combined with weight data. Nabarro and McNab devised a weight-height chart for field use (33). It is also known as the "Thinness Chart" because it establishes when children are low weight-for-height — "thin" or "wasted". Weight-height measurements are regarded as useful for evaluating the effectiveness of interventions (34).

Arm circumference is easy to measure and age-independent. An inexpensive colour-coded tape (the "shakir strip"), marked "normal", "malnourished" and "severely malnourished" according to reference arm circumference measurements, which can be utilised by illiterate health workers is used (35). A child whose mid-upper arm circumference measurement is below the desired norm is identified as malnourished. However, this method is valid only for children over one year of age. While arm circumference measurements are frequently used for screening purposes, they have been considered limited for use in long-term monitoring of individual children.

Another measure sometimes recommended is arm circumference-for-height. It was tested in a prospective study of mortality risk on 8000 children in Bangladesh and deemed valid to identify children at risk, especially between one and four years of age. Children below the 10th percentile of the standard arm

circumference-height ratio had a three-fold greater risk of mortality and those between the 10th and 50th percentile, a 50 percent greater mortality risk than children whose ratio was above the 50th percentile (36).

These alternative methods of monitoring growth will be discussed more fully in a later section.

1.2. THE PRESENT STUDY

Although growth-monitoring may be regarded as a valuable and desirable component of any health-programme directed to children, the proper conduct of growth-monitoring operations using weight measurements and growth charts in the field involves the fulfilment of some basic requirements. Important requirements for any meaningful growth-monitoring operation using this technology are that: (1) the growth data collected must be reliable and accurate; (2) they must be recorded and plotted in the growth chart in the correct manner; (3) the information in the chart must be interpreted correctly; and (4) such interpretation must be followed by appropriate action. How are these basic requirements being currently fulfilled in actual practice in those developing countries where growth-monitoring operations are currently on-going? In the ultimate analysis, the time and resources expended on growth-monitoring (especially in the current context of extremely scarce resources for health and nutrition programmes in developing countries) will be justified only if it can be shown that growth-monitoring has actually contributed significantly to decreasing morbidity and mortality and to improve child health and nutrition in the community. Well-planned, long-term studies are required to provide indisputable evidence of morbidity and mortality reduction. At this stage it must be at least ensured that growth-monitoring operations in developing countries are being conducted in a manner likely to yield valid and reliable data.

In the chapters that follow, the experience of "front-line" health workers in developing countries, in the use of growth charts is discussed. The questions addressed are:

(1) What have been the specific operational problems and constraints in the collection of reliable growth data under real-life conditions in the field?

(2) How has the information obtained in growth-monitoring actually been used to improve the health and nutritional status of children and to change attitudes and practices which underline child health and nutrition?

The observations presented here are based on extensive consultations and exchanges with health and nutrition scientists in several developing countries, on scrutiny of published and unpublished (restricted circulation) reports of experience with growth charts, on personal discussions with front-line health workers currently using growth charts in India, and on observations (by Meera Chatterjee) during personal visits to project sites in India where growth-monitoring programmes are currently on-going.

Currently programmes of growth-monitoring are being undertaken in a number of developing countries. However, here we must distinguish between small-scale (pilot) projects confined to small segments of the population (there must be several of these) and large-scale, national operations. Small-scale programmes, undertaken under dedicated leadership and conducted under supportive supervision, undoubtedly provide valuable insights, but they may not always be replicable, and for that reason conclusions based on them may be somewhat misleading.

The three countries in Asia where fairly extensive growth-monitoring operations employing growth charts are currently being undertaken are the Philippines, Indonesia and India. Fortunately, data on experience in the use of growth charts are available from all three countries.

In Indonesia, growth-monitoring is being undertaken as part of the massive National Family Nutrition Improvement (UPGK) programme. In 1976, an expanded UPGK programme was launched with the objective of covering 40,000 of the 60,000 villages in the country by 1984. Critical, in-depth studies of the current status of the programme including the growth-monitoring component are available (37), (38).

A recent review of the fairly extensive Philippines experience with the use of growth charts is also available (30).

In India, growth-monitoring is being attempted on a large scale in the Integrated Child Development Services (ICDS) Scheme, covering one-fifth of the country's administrative "blocks". In addition, there are several small-scale programmes undertaken by leading health scientists and practitioners in the

country. Growth-monitoring is also included in the World Bank-assisted Tamil Nadu Integrated Nutrition Project. Useful information on the experiences of field workers in all these efforts is available.

Programmes of a smaller scale are also in progress in other Asian countries, notably Thailand, Nepal and Bhutan.

In Africa, according to Kimati (39), a large percentage of under-fives in Kenya and Tanzania are being covered by growth-monitoring operations; and according to Morley (40), extensive growth-monitoring is also being undertaken in Lesotho, Botswana, Gambia, and Santa Lucia. It was not possible to obtain precise data on the actual conduct of these programmes, on the nature of the data collected or on how they are being used. Randriamanana, of the WHO Regional Office for Africa, states: "In the prevailing contexts (scales hardly available at village level, level of instruction of community health workers not enough to practice properly the weighing, communication problems hampering supervision), measure of weight and height could not be envisaged everywhere. So the African experience in the use of growth charts in Primary Health Care is negligible." (41).

However, Bailey (42) has provided some information from his vast experience of the African scene and this will be discussed later.

According to Gabr (43), there is no documented work on the use of growth charts in Egypt.

Some of the pioneering concepts in the field of growth charts emanated from Mexico. While papers describing in detail the Mexican experience in the field of growth-monitoring could not be directly consulted, the views of some leading workers in that country were obtained, and these will be mentioned later.

In India, apart from several small-scale programmes being undertaken under the direct supervision and guidance of leading health scientists in the country (many of whom participated in the Consultation Meeting specially convened for the purpose of this study, and helped the study with the benefit of further continued exchanges), two projects which provide considerable information on the use of growth charts are the nation-wide Integrated Child Development Services (ICDS) Scheme and the more limited World Bank-assisted Tamil Nadu Integrated Nutrition Project.

For the specific purpose of collecting information for this study, sites at which the ICDS Scheme is in operation were visited. Growth-monitoring is an important component of this programme. The programme currently extends to over 600 "community development blocks" in the country (and 400 more are expected to be covered by the end of 1984). Each block has a population around 100,000. This may be one of the biggest growth-monitoring programmes in a developing country. Six blocks in the States of Rajasthan and Haryana were visited. These blocks were selected on purpose, rather than at random, because the intention was to study the operation in areas where it was "firmly on the ground". In all these project sites, the programme had been in operation for at least three years. It was expected that the teething troubles which beset any programme during its initial period would have been overcome, and that the growth-monitoring would already be in full stride. The visits to these project sites enabled examination of growth-monitoring operations *in situ* and helped obtain first-hand information through discussions with workers at various levels on their experiences. Using an unstructured interview technique, primary level field workers (*anganwadi* workers), their supervisors and medical personnel associated with the programme were interviewed to elicit information on the following aspects: the type, use of, and performance of weighing scale employed; handling of children during weighing, and equipment used for this purpose; taking of weight measurements by the worker and their recording; time taken for weighing, and alternative ways in which the worker would have used her time if she did not have to do growth-monitoring; verification of the child's age and validity of age data; frequency and number of weighings per individual child; the workers' perceptions of the growth chart, the value she attaches to weighing and her understanding of the significance of the whole process; interpretation of growth data and relating them to other health information obtained; the ultimate use of growth data in the programme; follow-up action based on growth measurement; how advice and action were modified and influenced by growth measurement; mothers' acceptance of, participation in, and perceptions of growth-monitoring; impact of growth-monitoring on attitudes and practices of mothers; the issue of home-based as against clinic-based weighing; the preservation of growth charts; the costs of growth-monitoring; and, finally, doctors' perceptions of growth-monitoring in primary health care. The above studies became possible because of the cooperation and support extended by Prof. B.N. Tandon, who has been providing technical advice and guidance to the implementation of the programme ever since its inception.

In addition, a special study on growth-monitoring in the ICDS programme in Gujarat state was conducted by Tara Gopaldas with a view to obtain an evaluation of the adequacy of training and competence of field-level workers (*anganwadi* workers) to carry out growth-monitoring.

The collective experience with the use of growth charts, gathered from all the above sources, is discussed below. Instead of describing each country's experience separately, each operation involved in growth-monitoring is considered separately, and the experiences of all countries with each operation are discussed together.

2. Operational Considerations and Constraints in the Use of Growth Charts — Review of Experiences

2.1. MEASUREMENT OF GROWTH

When we discuss growth-monitoring in this report, we are for the most part considering the technology of growth-monitoring which consists of periodic weighing of children and plotting their weight measurement on the growth chart (“Road-to-Health” card or its modifications). The process of growth-monitoring, which uses the weight-for-age chart, begins with the weighing of the child. Weighing may be clinic/centre-based or home-based. It may be done by a para-medical worker or a village-level (primary care) worker. Several types of scales are being used in growth-monitoring operations in different parts of the world. Not all of them are appropriate. The worker concerned must first check the accuracy of the scales, and this has to be done from time to time since the accuracy may diminish with constant use, handling and transport. Any zero error at the time of weighing must be properly corrected. The actual weighing itself has to be done without the investigator touching the balance or supporting the child. The reading of the scale must be done carefully. The worker should wait for the arrest of the needle before taking the weight. All this care has to be sustained over many hours when the weighing of several children is involved.

Recording of the weight reading has to be done accurately on the weight-for-age graph. For this purpose, the child’s month of birth must be determined exactly and the correct age calculated accurately when the child is first weighed. Every month thereafter, the appropriate point on the graph must be located to plot the weight.

These seemingly simple steps actually call for considerable skill, care and patience. At every step in this chain of operations, there are potential sources of error to be guarded against. All this implies good training of the concerned workers, supportive supervision, and periodic checking of the validity of the data. Where training is defective, the worker is likely to be unskilled with regard to each of these steps in the operation, with the result that the final weight reading and recording will reflect the *cumulative* errors in the different steps of the operation. The data will then be unreliable and misleading and may be worse than none.

The different steps of the weighing process and the operational problems and constraints experienced are considered below.

Scales: Several types of scales are proposed for use in growth-monitoring programmes throughout the world (17, 32). The pan beam balance scale is considered the *most accurate*. This is especially suitable for very young infants but cannot conveniently be used for weighing children older than one year. These scales are high priced, difficult to transport, and require firm positioning for accurate weighing. Hence, they are rarely used outside of sophisticated clinics or hospitals. The balancing of weights takes time, and it is difficult to “read” the result, and a semi-literate worker may make frequent errors. The platform (or adult) beam balance scale, which is more suitable for weighing toddlers and older children, presents similar difficulties.

More portable and about one-fifth the cost are various hanging scales which are possibly more suited to community monitoring programmes. In these, children are suspended during weighing rather than seated or standing. These are of two main types—a bar type which is used in Indonesia, the Philippines, Thailand, Bangladesh and parts of India, which works by the movement of a counterweight along a beam. Although these scales do not have the precision of the pan version, they are more easily carried, and do not lose accuracy during transport. However, they require taring (or “zeroing”) before the child is positioned for weighing. The adjustment mechanism provided for this purpose, if available, is difficult to manipulate and so, taring may often be neglected. Some types, such as the Philippine model, cannot be tared and require the weight of the basket to be subtracted from the final weight. This is a potential source of error. For example, Fajans and Sudiman report that weight data they examined from the Indonesian National Family Nutrition Improvement (UPGK) Programme suggested that the two kilogram weight of the basket was occasionally not subtracted when the indigenous “Dacin” scale was used and that the weight of the weighing pants or sarong was always ignored (37). In addition,

in some models (such as the Tansi Bar Scale being used in Tamil Nadu, India) if the child weighs over 10 kgs., a 10 kg. counterweight must be added which is a time-consuming and hazardous procedure. "Reading" beam balance scales is frequently difficult because the needle tends to oscillate markedly and workers must "estimate" that fluctuations on either side are equal (37).

Another type of hanging scale is the spring type which has an easily readable dial face. These "Salter" scales are becoming the scale of choice in weighing programmes because of their compactness and easy portability. They were the main type of scales being used in the ICDS blocks visited for this study (although the bar balance is also in use in these programmes). They are easy to read—the kilograms are numbered prominently and clearly—and can be tared by simply turning a knob. However, like all spring mechanisms which stretch when used repeatedly, they are subject to losing accuracy with use and hence require *periodic checking*.

Observation of Indian projects carried out as part of this study showed that although the workers generally did tare (or "zero") the machines, there was little or no comprehension among them of the concept of standardising or checking the accuracy of the scale with known weights. Though some scales had been in use for five or more years—and the children appeared quite 'rough' with them—the workers had never checked them, nor did they understand the need to or know how to do so. However, the procedure was grasped easily when explained and its value understood. A number of machines checked against two or five kg. market weights were found to be up to 200 gm. off. Clearly, systematic errors may arise if scales are not checked regularly and frequently. Difficulties are likely, where the worker is not provided a weight to check the machine on the spot herself and/or not instructed to standardise the machine regularly. Cowan reports that Salter scales used in the project area of Christian Medical College, Ludhiana (India) are checked weekly for accuracy (44).

Suspenders: Several types of "suspenders" are used with the hanging scales — a plastic seat or net basket, "trousers" or "weighing pants" which may be made from either plastic or cloth, a seat made from rope and wooden batons, or a cloth hammock (sarong). Trousers are provided with the Salter dial scales. The child is first made to get into them and they are then hung on the hook of the scale. With some of the more cumbersome contraptions the 'seat' is first hooked on to the scale and the child is manoeuvred on to it. Workers were usually conscious of the weight of the hanging device if it was first hooked on to the scale *without* the child, and in this case they "zeroed" the machine. However, where "trousers" which were fitted on to the child before its being hooked to the scale

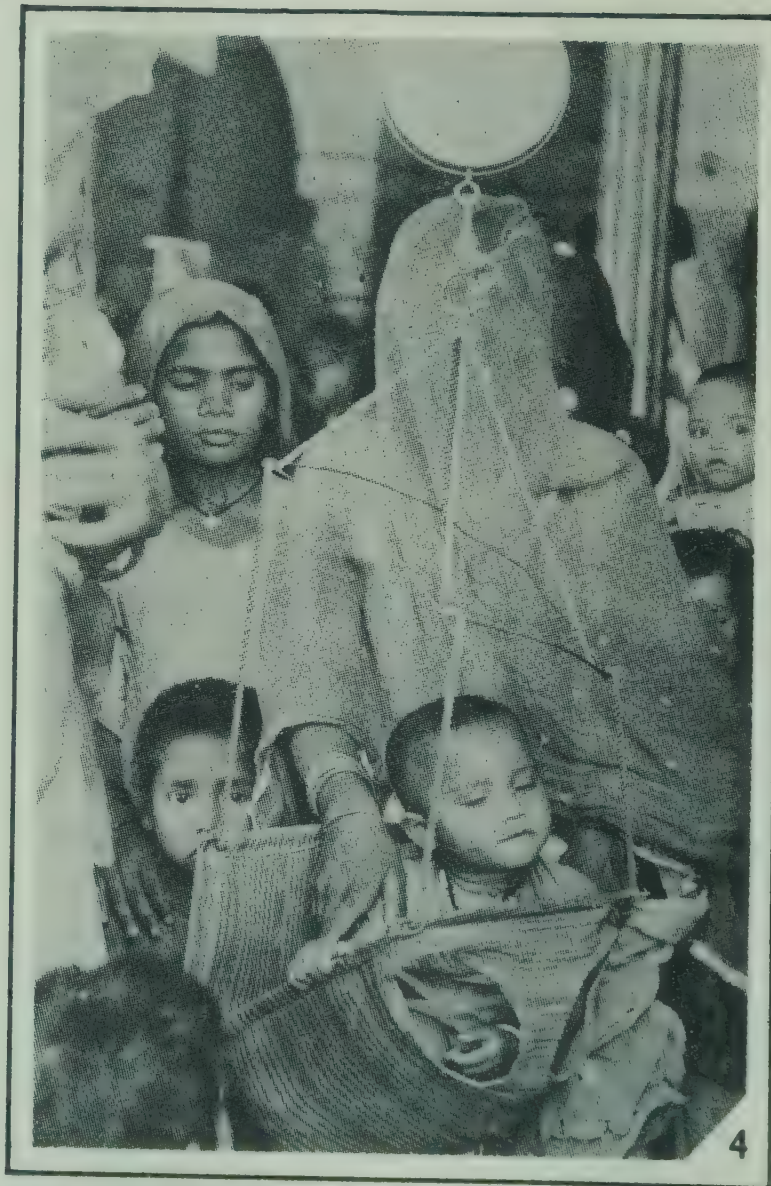
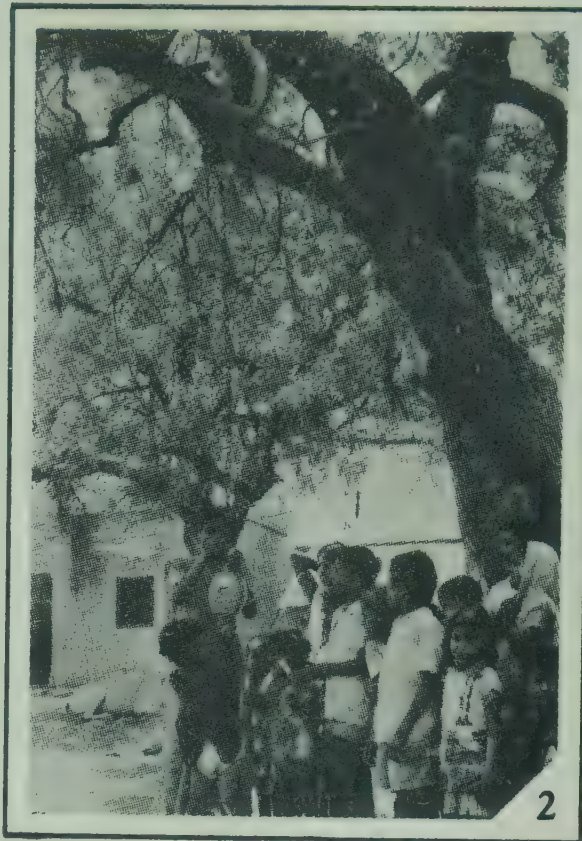
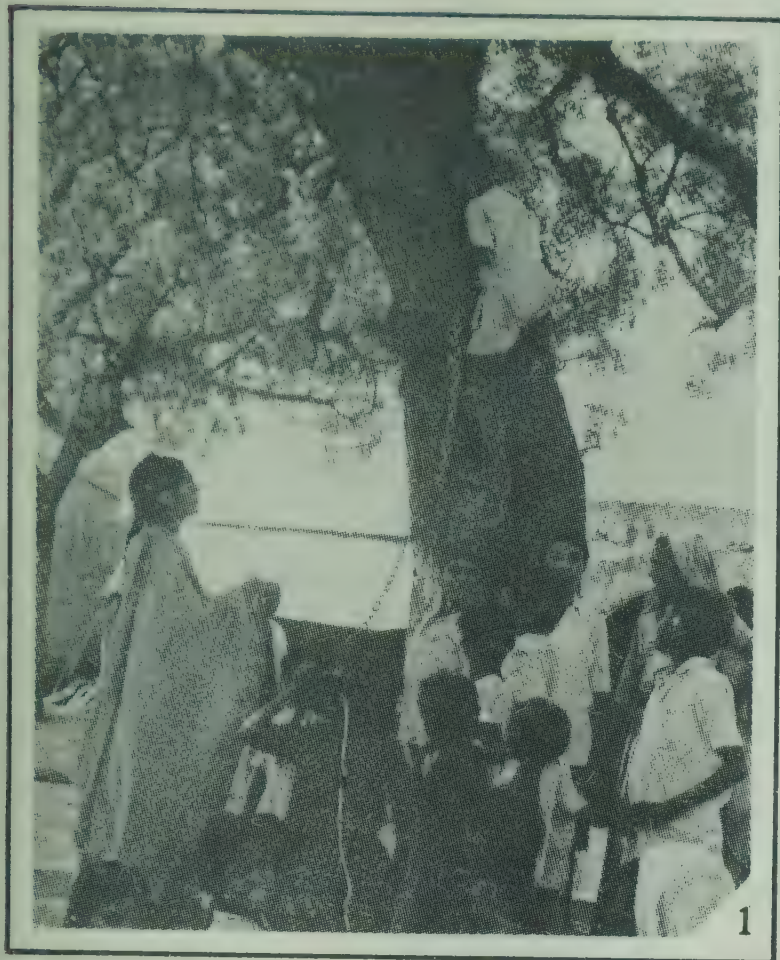
were used, the weight of the “trousers” was never adjusted or subtracted from the child’s weight. This results in a consistent positive bias of about 100 gm. in the weight readings. In addition, the practice of weighing children with their clothes on may introduce another source of ‘positive bias’ in weight data. Although the extra weight of clothes worn in hot climates may be negligible compared with the weight of older children, that of “swaddled” infants in cold weather might be sufficient to influence a weight reading. As Fajans and Sudiman have noted, the difference between 100 and 80 percent of standard weight at three months is only 1.2 kg. and between 80 and 60 percent, only 1.1 kg. (37).

Although several pairs of “trousers” are provided, it was found that generally only one was being used at any given time, thus lengthening the process of weighing when there were a large number of children. Workers said that the “trousers” were rarely soiled by the children, but that tearing with use was a problem and that they were unsuitable for bigger children, as well as infants. Others have also reported the latter complaints (45). In Indonesia, workers prefer the “sarong” for children under two-and-a-half, and find the weighing pants equally unsuitable for older children (37).

Vijay Kumar (46) reports that the “trousers” provided with Salter scales often “scare” the children, and cause them to “constantly thrash and howl leading to constant oscillations of the needle of the dial, making weight measurements difficult.” He also points out that this frequently upsets mothers who do not cooperate in subsequent rounds. He recommends that a *jhoola* (hammock)) in which the baby can be comfortably seated is the satisfactory alternative, though it is more expensive.

Hanging the scale: Hanging the scale occasionally presents problems. At the weighing centres, a hook may have been rigged from the ceiling or door jamb, but less suitable methods were also observed—such as the use of wooden posts jutting out of walls but too close to them to allow the child to dangle freely, resulting in loss of accuracy in the weight reading. Workers frequently had a mother or a helper hold the scale in their hands while taking weights, a risky business, (let alone the consideration of accuracy) to say the least. This method is frequently used in homes. In one centre, a rickety bed was stood up on end and one of its legs used as a “post”. One innovative worker in Rajasthan used the limb of a large shady tree outside the *anganwadi* from which to hang the scale with a stout metal chain. The result was fairly satisfactory and the children enjoyed the “swing” thus created (close to ground level, fortunately) but the procedure involved the rather hazardous practice of sending a 10 year old boy about 15 feet up the tree and out on a limb to secure the chain! In addition the

Growth-monitoring in an Indian Village



Figures 1 to 3 show the lengths (or the heights !) to which growth-monitoring operations are sometimes carried.

Figure 4. A woman in 'purdah' having her child weighed.

worker had to stoop to suspend the children and to read the dial — which, along with trying to control their high-jinks, appeared a rather tiresome business. The accuracy of weight recording under the circumstances must indeed be open to doubt.

Reading the weight: Reports of children moving and crying during weighing are common. When several children are gathered together for weighing, this could indeed create an environment totally unsuited for persuasive nutrition education. The *mechanics* of the weighing process naturally gets the greatest attention. It was observed that the workers in the ICDS programme generally handled children with ease. Field workers admitted to having difficulty in handling the children in the initial stages of the weighing programme but claimed that children gradually got used to—even enjoyed—being hung! Where an experienced worker was doing the weighing, the children were usually “placed” correctly and appeared confident, though some, particularly younger ones, were obviously discomfited and frightened by the process. With an experienced worker and a child who is not fidgety, a weight reading could be taken within 30 seconds of suspending the child on the dial-type scale. Even with fidgety children the needles of Salter scales did not oscillate markedly. However, oscillation problems are frequently reported, and to avoid this, a “damping” system has been advocated (47). It was found that workers generally did wait for the needle to come to a halt before taking the reading. However, they were sometimes given to lightly supporting a moving child while taking the reading—which occasionally influenced the weight (by about 100-200 gm. positively or negatively). At least, some workers report difficulty in “reading” the weights. It has been suggested that special scales equipped with large dials be used to train the workers in reading to avoid reading errors (48).

The Salter scale will weight children up to 25 kg. Although it is available in 100 and 500 gm. markings, only the latter were seen in the ICDS centres—and the workers tended to estimate divisions in between on their own, such as “250 gm.” or “800 gm.” These ‘estimates’ are liable to errors which could be avoided if scales with divisions of 100 or 250 gm. are used instead of those with 500 gm. markings. This precision is also desirable because monthly weight gains after the second year of life tend to be small. When weights of children in this age group are read only to the nearest 500 gm. they may be stationary for many months leading to wrong interpretation of the weight curve. However, on the whole, relatively few *reading* errors were observed with these scales. In contrast, Rohde *et al* (46) have reported that health workers are prone to consistent balancing and reading errors with the beam balance scale. They concluded that while hanging (dial-type) scales may be inherently less accurate, they may be more reliable than beam balance scales in the hands of village level personnel.

Care of the scale: Although, during use, the scales are subject to rather rough use, it was observed that the workers generally kept them carefully, storing them in their original cardboard cartons in a cupboard, between weighing days. Although the accuracy of the scales was not checked, there were few complaints of total breakdown. However, when scales were broken, their repair was reportedly difficult. The workers and their supervisors said that there was no way of having them repaired locally, and replacements were slow to arrive. (In cases where workers did not have their own scale or had to surrender a broken one, they borrowed a neighbouring worker's scale, but there are many locations in rural areas where this would not be possible.) These dial-type scales are roughly double the cost of the hanging bar scales (about Rs. 350 or \$ 35). For the ICDS programme in India they are provided by UNICEF, but cost considerations may lead to their being replaced by bar scales in the future. In any case, no long-term national programme can be continuously dependent on supplies from international or bilateral sources, and thus local manufacture and/or low cost are important considerations.

Cost of scales: Vijay Kumar (46) has estimated that even at a cost of Rs. 300 (\$ 30) each, to purchase Salter scales for a single district of one million population in India would work out to a capital outlay of Rs. 0.3 million. An annual recurring expenditure of Rs. 60,000 would be required to cover the cost of replacing worn or damaged balances. (The balances have a 'life' of about five years.) A growth-monitoring operation on a national scale in India, on the basis of the above estimates, would involve an initial expenditure of Rs. 210 million (\$ 21 million) plus an annual recurring expenditure of Rs. 42 million for the scales alone! This is probably an underestimate, as the cost of the scales may be higher than the Rs. 300 used by Vijay Kumar. It must also be pointed out here that the cost of scales and their maintenance constitutes only a very small part of the cost of the entire growth-monitoring operation. These facts have to be taken into account when we consider the place of growth-monitoring in primary health care.

Unsuitable scales: Although "bathroom (platform) scales are intended primarily for use by adults and are considered unsuitable for the weighing of children, it was found that in some ICDS programme areas and elsewhere they were being frequently used. These scales are inaccurate, and most probably insensitive in the 0-25 kg. range required for young children because they are designed to weigh up to 120-150 kg. They have inappropriate markings, and go out of adjustment with use. These potential problems were *not* recognised by the concerned ICDS workers. They cited the ease with which weighing could be

done (and the fact that children did not cry) on bathroom scales as the main reason for using them rather than the Salter hanging scales also in their possession. Older children could be lined up and marched on to and off the scale quickly, while younger ones were simply held in their mother's (or the worker's) arms and "weighed by difference". (Sometimes older children are weighed on the bathroom scale and the younger ones on the hanging scale.) Weighing large numbers is therefore facilitated by the use of bathroom scales.

To overcome problems of cost and import, some investigators in India have experimented with the use of local market balances, but two major problems have hampered this approach. Weights over five kg. are difficult to get in some village settings; and mothers object strongly to their children being weighed like "commodities" (46, 50). On the other hand, the 'Dacin' scale used in Indonesia is indigenous and is reportedly well accepted.

In Indonesia's UPGK programme, which now extends to some 27,000 villages, a single weighing post in a village may have two or more scales in use simultaneously on weighing days. Despite this, there is usually a crush at the weighing stations and several observers have advised that additional weighing scales should be provided (38). Shortages of weighing scales are also reported in weighing programmes in the Philippines (30) and in non-governmental projects which include growth-monitoring in India (50).

At the Comprehensive Rural Health Project in Jamkhed, Maharashtra (India), Arole reports, bathroom scales were used initially (50). In addition to being inaccurate, it was found that they did not stand up to being transported between villages and required replacing within six months. This made the costs prohibitive. They have since been replaced by Salter scales. However, Arole feels, as do several other people contacted, that the problem of cost remains—so that one scale per village though desirable, is an impossible standard to achieve. If scales have to be "shared" (i.e. transported) between three or four villages, as is the case at Jamkhed, logistics are difficult. It takes six to seven days per village and thus over a month for the three to four villages to complete weighing. In addition, damage is frequent, and replacement is both difficult and costly. Agarwal reported that in her field area near Varanasi, U.P., neither community health workers nor their supervisors (one male and one female for every five to seven villages) have weighing scales (45). Scales are entrusted to clinic-(sub-centre) based health workers who cover a population of 20,000 or 25,000. Under the circumstances, the logistic problem involved in transporting scales to villages cannot be surmounted. If weighing has to be done at the village level, 'a scale for every village' is a must. However, the cost of supplying one Salter scale to every

village, of arranging for their frequent checking, repair and replacement, would constitute a significant proportion of the health budgets of most developing countries.

It is clear from the foregoing account that, if growth-monitoring operations are to become a routine component of the health system, proper arrangements have to be institutionalised for (a) procuring the right type of scales needed for the operation, in adequate numbers, (b) properly standardising, calibrating and frequently checking their accuracy, (c) promptly repairing and replacing them in the event of breakdown, (d) transporting them to the 'front-line' and (e) a system of feed-back of information from the field to detect deficiencies and shortcomings. At present, such arrangements are not part of *any* of the ongoing growth-monitoring operations.

2.2. CHARTING GROWTH DATA

For effective growth-monitoring, a child's weight must be recorded against his age and serial weights-for-age must be readily comparable. Plotting weight data on the growth chart permits this. It also enables comparison of the child's status with the desired norms or reference standards and thereby, estimation of the degree of growth deficit. Many different kinds of growth charts are available worldwide. The most commonly used are based on Morley's "Road-to-Health" design. This graph has age in months on the horizontal axis and weight on the vertical axis. The years (first, second, and so on) may or may not be differentiated by "steps" and various cards provide for only three years, or for the first three years on one side and the fourth and fifth years on the reverse, or, even up to six years on one side. Woodland and Kelly examined some 100 growth charts collected from developing countries throughout the world, and made several observations and recommendations (51). They observed that cards with more than three years on one side may be too crowded for marginally literate health workers to fill in accurately. They suggest that a space of 5.5-7.5 mm. for each month is required to record the dates of weighing and plot weights at least for the first three years. This may be reduced to a minimum of 3.5 mm. from the fourth year onwards. The chart recommended for use by WHO has too little space for recording the weight data of children in the fourth and fifth years. The point that the space for recording dates and plotting weights should always be adequate for semi-literate workers (five years or more of schooling)—who tend to have a large hand-writing—has been frequently emphasised (52). From observations in the present study of charts in use, it is clear that field workers have difficulty with the very narrow spaces (e.g. two to three mm.) provided in the charts. At any given time, especially at the start of a programme when

workers lack practical experience, a worker has to record the weights of children of all ages, if space is cramped, the recording may be unintelligible and not capable of being interpreted.

Plotting the child's weight is not as easy as it is often made out to be. Many workers do not know where to put the dot (whether on the line or inside the grid). Often, even medical scientists have been found to make mistakes (53). Bailey found up to 80 percent errors in plotting of weights by undergraduates trained and experienced in the job, and states that field workers require constant training, checking and recording practice (54). Workers may find it difficult to locate the weight-month junctions to plot the points (55). It was observed that even though some cards were designed specifically to have the dots located in the grid space, workers preferred to plot them on lines. Tremlett *et al* (31) have suggested that the printing of lines should not be too dark, to enhance clarity, and that half and one kg. lines should be light (or broken) and heavy (unbroken) respectively, to permit greater accuracy. They mention that cards in which graphs for each year are separate cause confusion. It was observed in this study that workers frequently misplaced points when they began a new section such as on cards where the third and fourth years were discontinuous. Fajans and Sudiman also report that the repetition of the 36-month block on both sides of the Indonesian card results in many recording errors (37). A straight horizontal axis is preferable to the step design. On the other hand, it has been suggested that the weight axis should be printed at the start of every year rather than only on the left or right (or both) ends of the charts, to make the weight lines easier to follow along horizontally (55).

Cards which divided a kg. into thirds were seen in the ICDS programme. These confused the workers as they bore no relationship to the scales being used and were not easy to relate to weight readings taken. Thus, it must be reiterated that weight divisions on a chart should match those on the scales being used to weigh the child, to facilitate recording of the weight information (31).

The "time dimension" of growth charts creates much confusion. For example, although the charts found in use in the ICDS programme were designed with the "calendar system", workers did not use the method correctly. The usual practice was to fill in the weight data in the next available space. This practice may be acceptable if weights are taken regularly and at the same time each month (which, as will be discussed below, is rarely the case). A month (or even more) is frequently missed and often goes unnoticed because of faulty recording. Sometimes even when weighing is done in the two consecutive next months, the dates of weighing between the previous and present months do not

correspond. Thus the child may have been weighed at the *beginning* of one month and at the end of the following month, but the recording of the weight on the graph by the worker does not reflect this. Workers did not consider the option of plotting points within the grid instead of *on* the lines. These observations suggested that workers really did *not* understand fully the “monthly weighing” basis of the growth chart. Some workers calculated the child’s age at the time of each weighing and filled the appropriate box with the date and recorded the weight on the chart accordingly. This is a time-consuming procedure, and unnecessary, given the calendar design of the chart, and it often resulted in errors. Similarly, Fajans and Sudiman found that when a child missed a weighing, the month was not skipped. This resulted in all successive weights being entered at a lower age and introduced further “positive bias” in weights. This was the most frequent problem encountered with weight recording (37). Abraham Joseph reports that even doctors may not record the child’s weight in the column pertaining to the child’s age at the time of weighing (53). Morley and Woodland (17) have stressed the need to get workers to fill in the month of birth and all subsequent months at the child’s entrance into the weighing programme to avoid both these problematic procedures. They have suggested that charts which emphasise the box for the first month of every year (the month of birth) could serve as a check against these errors.

Clearly, in actual field conditions, recording errors are no less than errors in weighing, and weight data would reflect the cumulative error of both these operations.

Verification of age: Another major source of error in recording weights on growth chart is the uncertainty regarding the precise age of the child. Since the growth chart is used to assess a child’s nutritional status by his weight-for-age (and compares him with a reference standard), it is absolutely essential that his age is accurately known. An underestimate of two or three months could result in the child being considered better in nutritional status than he actually is. Obtaining the correct age of a child in an illiterate community which has no birth records is not easy. This fact has always been cited as a principal deterrent factor to the use of growth charts in the past and is still largely true. However, the development of the simple method of age assessment using local events calendars may have somewhat changed this picture. Although there are some reports (53) that a child’s age may be wrongly reported by mothers by as much as one year, particularly for older children, most investigators claim accuracy in age verifications using local events calendars (52). Workers in the ICDS programme interviewed in this study claimed that this aspect of the charting procedure was simple, and considered their age determination reliable, but it was, unfortunately, not possible to check this claim in a sufficiently large number of

cases. It was, however, noticed that while workers “established” the month of birth according to the Hindu calendar, they wrote Gregorian dates on growth charts. These two calendar systems do not correspond exactly, the former also changing from year to year. Fajans and Sudiman report that a similar problem occurs in the translation of local Indonesian dates to a Western system of recording (37). While it may be easy to ‘translate’ current dates, it is far more difficult to establish the month of birth of a child born three or five years ago. Thus, it is possible for errors to creep into age data even with the use of local events calendars.

Any initial error in the verification of age persists, and is compounded by “missed months”. Reverification is seldom, if ever, attempted and so correction does not occur. Karyadi has noted that age assessment was improved by repeated interviews associated with local events (56). After two years of programme operation in Indonesia, age errors decreased. Thus, errors in age recording may be more frequent when a programme is first staged. For example, Agarwal has also observed that the month of birth is frequently confused with the month of a child’s first visit (45). As a programme is established, mothers may be contacted at or shortly after giving birth and the child’s birth month may be known with better accuracy.

It will thus be seen that recording weight data is a highly sophisticated procedure and not the simple one it is assumed to be. The pitfalls are several, even for an experienced worker. For the illiterate, relatively inexperienced workers, total avoidance of errors could well be the exception rather than the rule. Accurate plotting requires clearly-designed cards and thorough training, especially for semi-literate workers to whom the concept of the graph is entirely new. For any growth-monitoring programme to be at all reliable, there must be a substantial investment in training. Special aids for training purposes will be useful. Practice produces better results. It was found in the present study that the majority of workers plotted points with certainty only after they had completed at least one year of maintaining growth charts. Growth chart data collected during the period of “in-service training”, when the workers are in fact inexperienced are, therefore, likely to be quite unreliable.

A practice observed frequently when groups of children are weighed at the same time is that of writing weights down in a register or on a sheet of paper, and plotting these on growth charts later. Indeed, this procedure has been ‘systematised’ in the Indonesian UPGK programme in which weights are taken at one “table” in the weighing post (centre) and plotting on the chart done at another. Two different workers are involved (37). In fact, sometimes weights are

“shouted” by the worker at the weighing station to the one recording! This practice has the inherent danger of transcription mistakes. Furthermore, weighing a child and not charting his weights simultaneously is of little value because neither the worker nor the mother is able to visualise the child’s growth or nutritional status on the spot. The child may seem to be gaining weight if serial weights are recorded in the register, but a poor weight gain will be missed unless it is compared with the reference lines.

Growth charts: The assessment of nutritional status in a cross-sectional study of a population is based on a comparison of the child’s weight-for-age with a reference standard. In growth-monitoring operations, however, apart from the actual weight of the child, the “slope” of the child’s growth curve between measurements, compared with that of the reference curve, provides information on the velocity of the growth process. It tells us whether an undernourished child is “catching up”, deteriorating or maintaining the *status quo*. This is the real merit of growth-monitoring; but as we will see later, it is precisely this aspect which field workers do not comprehend, perhaps for lack of adequate training.

The growth charts currently in use contain, apart from the reference standard curve (which represents the level of optimal growth and is equivalent to the 50th percentile of the Harvard or NCHS growth standard), other reference lines representing levels of growth performance lower than the reference standard. These reference lines are used as cut-off points to denote grades of undernutrition. They may be “modifications” or local adaptations of the Gomez classification of undernutrition on the basis of growth retardation. The growth charts being used in ICDS in India contain three reference lines in addition to the standard, representing 80 percent, 60 percent and 50 percent of the reference standard. In many growth charts, these cut-off limits are reinforced by a colour scheme—such as for example, a green zone between the reference standard and the reference line representing 80 percent of that standard, a yellow zone between the lower limit of the green and the reference line representing 60 percent of the standard, the cut-off point between “moderate” and “severe” undernutrition, and so on.

The majority of cards use the Harvard reference data, according to Termlett *et al*, (31) and the percentage method of gradation. The WHO Manual on Public Health Nutrition recommended that all charts have a line at the level of 60 percent of the standard weight for age which corresponds to the “level” of marasmus. Bailey feels strongly that such a line be clearly demarcated to pick out children with severe malnutrition in places with a high prevalence of marasmus (54). Some charts have as many as nine reference lines (31). Others, such as one

from the Philippines, use "shading" of narrow channels to denote smaller differences in percentages of the reference standard but to emphasise the growth path rather than the grade of malnutrition. Different colours and shades make it easier for the worker to establish a child's nutritional grade and growth performance. Ghosh (55) as well as Anandalakshmy and Sindhu (57) have proposed that such colour-coding be done on Indian cards to make it easier to chart and interpret weights. The choice of colours must be "culturally appropriate", as demonstrated by the experience of Project Poshak in India (58) which modified the "Western" colour scheme used originally to conform better with local values. However, Tremlett *et al* (31) have cautioned that colour coding may be associated with rigid interpretation of data rather than acting as a guideline or an educational aid.

In some charts, reference lines do not begin from birth but from the age of six months or later. This prevents assessment of growth in the critical period from zero to four months. For diagnosis of growth faltering in this period of rapid growth, reference lines should begin at birth. This would also alert the worker to low birth weight infants who require special monitoring (provided, of course, that the child's birth weight is obtainable) and to infants who are being inadequately breastfed (59).

It must be emphasised again that these reference lines and cut-off points, reinforced by attractive colour schemes in several growth charts, are *wholly arbitrary* and have no proven physiological validity. They must be used with circumspection and full appreciation of this arbitrariness and its limitations. The limitations of these arbitrary cut-off points and classifications have been discussed elsewhere (21). Unfortunately, in many on-going growth-monitoring operations, the growth data are used primarily to identify beneficiaries for nutrition intervention—those who qualify being the "moderately" or "severely" malnourished—rather than to monitor child growth. This has sometimes resulted in the neglect of children who are undernourished but not severely enough to descend into the qualifying 'yellow' or 'red' zones of the growth chart. One might conclude that when this practice is adopted, growth-monitoring is being used *not* to get a true picture of the magnitude of the problem of child undernutrition or growth retardation in a community, *not* to detect early growth faltering, but to 'reduce' the number of undernourished children on paper, to proportions which are manageable within the resources available for a given project.

It would seem ironic that while, on the one hand, we strive for accuracy in weight reading and recording to identify the precise magnitude of growth

retardation and detect early growth faltering, on the other hand, we resort to wholly arbitrary systems of "classification" of growth data, which help to "write off" much of the undernutrition which is laboriously identified by the time-consuming and expensive weighing process. The basic question, which we will return to later, is: is it the purpose of growth-monitoring to enable *early detection* of growth retardation so that mothers can be properly advised and alerted *in time*; or is its purpose merely to select beneficiaries by identifying and concentrating on so-called 'moderate' and 'severe' cases of undernutrition. In the latter case, the growth-monitoring is not being used for a truly preventive programme but in a (curative) relief and rehabilitation operation. This is in total contradiction of the prime purpose of growth-monitoring, as stressed by Morley and others (17), which is prevention of severe malnutrition by attention of early signs of growth faltering and the underlying health cause. It could legitimately be argued that a strategy which uses growth-monitoring mostly to identify candidates for repair and rehabilitation is tantamount to a "nutrition policy to brinkmanship" (60). It may help to *prevent mortality* (i.e. improve "child survival") but not to *promote* child health and nutrition. We will return to this discussion later in this report.

Health card: In addition to the growth chart or weight-for-age graph, there are also other types of information printed or to be recorded on the "child health card" as discussed earlier. This additional information is intended both to aid in the 'diagnosis' of the child's health problem(s) and to ensure and facilitate follow up action. The incorporation of the growth chart into the health card underlines the relationship of growth to health parameters. Growth faltering may be due more to infectious illness than inadequate feeding *per se*. What is included in the health card depends on who retains the cards (whether primary level worker, clinic, or mother) and the scope of the programme which includes growth-monitoring. At the least a growth-monitoring scheme must be accompanied by inputs to detect and deal with the common childhood infections. The value of the weight chart itself depends on the role of growth-monitoring within the programme.

However, there are strong feelings among professional workers that the child health card used at the primary level should only provide for the collection and transmittal of necessary information (52). It should not be crowded or cluttered. Information on immunisation and special care is considered most important and it has been suggested that this space be provided on the same side of the card as the growth chart (55). It has also been suggested that a space be provided to enter the dates on which immunisations are *due*, to serve as a reminder to the worker and/or the mother (45). Some cards which mark months on which immunisations are due by shading or with symbols are available (31).

It was observed in the visits to ICDS centres that while dates of immunisations were recorded, 'Reasons for Special Card' were never mentioned. The latter are important to remind the worker to pay particular attention to 'at risk' children and address, if possible, the reasons underlying their poor health status. Tremlett *et al* (31) have suggested that a list of 'Reasons for Special Card' provided with boxes to be ticked off when relevant, is more likely to be used than "open-ended" space for this information.

The utility of information on the child's illnesses clearly depends on the objectives and priorities of the programme and the capability of the health worker recording them (or some other health worker) to follow them up. Cards have been criticised for emphasising outcomes and providing no space for action taken or recommended (17). At clinics, separate cards may be used for this purpose.

Certain other categories of information may be 'culture specific'. For example, while Tremlett *et al* (31) stress the need for space to record the names etc., of siblings, investigators in India feel that this is unnecessary and that information on other children in the family can be adequately substituted by a space to record the child's birth order alone (52). This information is frequently collected for family planning purposes, which Tremlett has noted often causes resentment (61). Many investigators feel that the health card, intended to promote child health and nutrition, should not be tied up with family planning procedures (52).

Many also consider superfluous the printing of *instructions* on the cards when illiterate mothers are involved, or for health workers who can be provided a separate booklet (52). Clear labels are preferable to "instructions". In fact, in one card seen in the ICDS programme, the entire reverse side was filled with instructions which the health workers admitted to never reading, while the front face of the card even lacked space to write the child's name! Tremlett (61) has also noted that on a small percentage of cards examined, the instructions provided were wrong.

From the point of view of growth-monitoring, the most important information to be printed on the cards is perhaps that which reminds and assists workers to interpret the child's weight curve and investigate and follow up the child, such as a diagram showing good and poor weight gains and danger signs,

along with space to record reasons against the latter two categories. Also, as health workers frequently miss a weighing, it may be useful to provide space to record the reasons why—such as the child's absence from the village, non-attendance at the centre if the weighing is centralised, etc.

The use of symbols may be confusing. For example, one card in use in the ICDS programme had tiny pictures of a boy's and a girl's faces which were intended to be checked or crossed out to identify the child's sex. However, the health workers thought these were decorative items and did not record child's sex at all!

Illustrations on charts are intended to impart information on child nutrition and health care and to make them attractive to mothers. They need to be simple and large to be understood—and culturally appropriate for the messages to be internalised. Frequently, they are not so, such as those showing meat, fish and eggs as desirable foods to poor (and vegetarian) mothers.

Tremlett *et al* (31) and Woodland and Kelly (51) have also examined other characteristics of child health cards and suggested effective ones. For mother retained cards, appearance, size and durability are paramount considerations. On the whole, the card must be large enough to accommodate an easily readable and useable weight-for-age graph and whatever other information is deemed necessary, but not so large as to be cumbersome to those who handle it (workers and mothers).

It is also difficult to maintain health workers' or mothers' interest in the card unless it is durable and easily preserved. Thus, the paper used should be of a kind that does not soil, does not absorb ink, and does not tear easily. Some of the growth charts seen in the ICDS programme were simply printed on sheets of paper and bound in book form. Others were "cards" which the workers usually tied together. The use of plastic envelopes is usually recommended for mother-retained cards (though it has been observed that mothers may use the 'precious' plastic bags for other purposes! (50). They are unnecessary for worker or clinic-retained cards. A new "plasticised" card which apparently costs 40 percent more than the ordinary card has become available and may be useful (40).

Clearly, the design of the health card as a whole must be tailored to its users—and, thus, would vary according to whether it is kept by health workers

or mothers. In many programmes, the actual “target group” is inadequately specified, and so confusion of information on the card is inevitable.

In sum, the crucial aspects of card design are that they should provide adequate space for recording with large handwriting and call only for information that the health worker is likely to *use*. Putting *necessary* information on the same side of the card facilitates interpretation and use. The weight-for-age graph should be clear—i.e. contain the minimum number of lines, colours, etc., necessary for easy and accurate plotting and interpretation. Some of the information sought and instructions and education provided are likely to be culture-specific and particularly need to be tailored to the “level” (of competence) at which the growth-monitoring service is operating, and its scope. “Cards need to be simplified for health workers and *doctors*, leave alone mothers” (52).

Logistically, inadequate supply and slow replenishment of growth charts would appear to be a common problem. Solon (30) reports this as a major deterrent to the success of growth-monitoring schemes in the Philippines. It was found that workers in the ICDS blocks in Rajasthan visited in the course of this study had been provided only a quarter to a third as many cards as there were children whom they were responsible for weighing. When there is a shortage of cards, growth charting is disrupted and not valued highly by the worker concerned. Children most in need may not have cards and thus not be weighed; and procedures such as writing in registers may be used which render the weighing almost a purposeless exercise.

Some alternative record systems are being used for serial weight-age information besides the growth chart. A “growth table” has been devised in the Philippines which lists the range of possible weights in columns below the age in months. Rows of weights are shaded in three shades of blue (similar to the growth curves) according to normal, mild, moderate and severe malnutrition (30). The worker enters the child’s weight in a space provided for this each month, and marks the box representing the range in which the child’s weight falls. This device may overcome problems inherent in the plotting procedure but it requires a high degree of numerical literacy on the part of workers, and its interpretation is as complex as that of the growth chart. And so, it would not appear to have major advantages. Composite charts containing anthropometric data on height-for-age and weight-for-height in addition to weight-for-age are also reported (30).

2.3. HOME-BASED AND CLINIC-BASED GROWTH-MONITORING

In most developing countries, a majority of children in rural areas suffer from growth retardation as a result of the synergism between inadequate nutrition and recurrent infection. Growth-monitoring is intended for early diagnosis of growth retardation so that timely action can be instituted. Prevention of growth failure is predicated on the identification of "at risk" children. An effective growth-monitoring system requires widespread coverage and must be linked to provision of appropriate health services. Thus, to evaluate the usefulness of growth-monitoring, it is important to consider who is weighed. This depends largely on whether the weighing programme is entirely centre-based or employs in addition (or predominantly) a home-visiting technique. It also depends on whether the programme specifies a target group within the universe of children under six. Cultural acceptance of the programme and the extent to which it motivates children and mothers (or their proxies) to participate are also important determinants.

Clinic/centre-based monitoring: Most village-based growth-monitoring programmes weigh children at a central location: a "weighing post", an *anganwadi*, a child care centre, or even in a village square on appointed days. Some may expect clinics or centres located in one village to weigh children from several surrounding villages. These centre-based programmes concentrate on children coming to the centre, and thus may exclude several categories of children. Each of these 'exclusions' lowers the utility of the growth-monitoring programme. First, there are those whose families are not motivated to take them/send them for weighing or to the centre in general, or for whom the opportunity cost of attending the weighing session is not perceived to be offset by the advantages of weighing their child. Unfortunately, unmotivated families frequently come from precisely those socio-economic or cultural groups whose children are at high risk of malnutrition. Malnutrition is higher among poor families for whom the opportunity costs of attending centres are greatest. Younger children (e.g. those from zero to three years of age) who cannot reach the centres unaided and so must have a sibling or a mother take them, or who are being breast-fed, may be at a particular disadvantage. A child may not start coming to the centre until he is taken off his mother's breast and put in the care of a mother-substitute. Recent studies in India (59) and elsewhere (62) have pointed out that nutritional problems start within the first six months of life when growth is rapid, and so monitoring would be most useful during this period. It is well established that rates of illness and death are high during the weaning period. Children who are ill may also be unable to attend centres. They may already be malnourished and at severe risk.

The experience of the Indonesian UPKG programme is instructive in this regard. Weighing is carried out only at weighing posts on specified days each month (although workers make home visits to motivate mothers to attend).

An in-depth study conducted by Fajans and Sudiman of seven villages in the programme provides several insights into this situation (37). While the programme was initially targeted at all village hamlets, it was actually implemented only in a subset of hamlets, largely because supplies were limited and had not been calculated on the basis of the under-five population or the number of hamlets. Thus hamlets further away from the main village were neglected. On one village, all 131 under-fives had cards. Over the year prior to the study, an average of 48 percent had been weighed each month. Distance to the weighing posts and demands on mothers' time were the main explanations given for the low percentage of children weighed. Attendance of mothers from more distant areas was lower, especially during the rainy season.

In another village, 86 percent of children were enrolled and 50-60 percent were weighed every month. The creation of more and spatially distributed weighing posts, so that the majority lived within 10 minutes walk from the centre and all within 30 minutes, increased participation. One village had 10 weighing posts, covering four hamlets. (Scales and other equipment were initially shared but later provided for each post.) In other villages where participation was higher, it was explained by the strong motivation provided by village leaders and workers on home visits, and the workers' sincere efforts to weigh all children, either by increasing the number of days on which weighing was done at the centre or by weighing children in their homes (although the UPKG programme does not specially include this strategy).

Similar experience is reported in India. Arole noted that, at Jamkhed, it has been a problem to collect children from peripheral hamlets for weighing at a central location in the village (52). Difficult terrain is another cause of 'exclusion'. Patowary (52) reports that 10-40 percent of eligible children in the rural ICDS block near Guwahati (Assam) could not be provided growth charts or weighed. It must be mentioned, in this connection, that the inputs in the UPKG programme in Indonesia are far greater than in the ICDS programme in India, although the programmes have similar objectives. Both programmes appear to have serious coverage problems despite different strategies. Both provide valuable insights for other developing countries which may embark on national child health and nutrition programmes.

Besides distance, Fajans and Sudiman report that a child's sex and age have a bearing on attendance at the UPKG weighing posts, while socio-economic status apparently does not (37). While 30 percent of children entered the programme by one month of age, 25 percent did not enter until they were over seven months (although new arrivals in the villages were included in this calculation). Earlier attendance is desirable because declines in nutritional status begin at five or six months of age. A higher percentage of girls than boys were brought for weighing by mothers because they were more easily 'found' around the house and, for the same reason more younger children attended. In one village, where zero-threes were enrolled, participation during one month was 76 percent.

Unfortunately, population-based enrolment and weighing data are not yet available for the ICDS programme. However, field enquiry in the ICDS blocks in Rajasthan and Haryana showed that at most sites, only 30-40 percent of children registered were weighed at the centres. The importance of the above variables to the question of who is weighed was also evident (although the specifics appear different from those in Indonesia). For example, it is widely acknowledged that a lower percentage of children under three, than of those between three and six years come to ICDS *anganwadis*. A higher proportion of boys are brought by mothers than of girls because of the culture's special interest in the welfare of male children. Workers did report that those children who lived further away from the centre attended irregularly, if at all, and that the poorest families often did not come to the centre either because of dependence on the mother's wages or because of suspicion or disinterest in the programme. Patowary reports that at two different *anganwadis* in Assam the percentages of children weighed was as different as 60 and 90 percent (63).

Even in special research projects (as opposed to routine operations like ICDS), it may not be possible to weigh all children in a village, as Fajans and Sudiman have reported (37). While their study intended to weigh all, including those not registered in the programme, by means of follow up, only those who attended the weighing post were finally weighed "due to time constraints on the part of the kaders (workers), absence of the children from the village, and a variety of other factors". Even when special efforts were made to solicit attendance and a second session held, about 30 percent of children were not weighed.

Indeed, low attendance is a major weakness of centre-based weighing programme and various mechanisms have been instituted to address this problem. Drums and loud-speakers have been used to announce the start of

weighing activities, as in some UPGK villages. Weighing may be held on more than one day, as is the practice in the ICDS *anganwadis* and also occurs in some UPGK villages. Frequently, health workers visit homes to motivate mothers to attend the centres at least to have the child weighed every month. Variation in coverage thus often depends on the extent of effort on the part of the motivator.

A major question arising from these observations relates to the specification of the target group. Growth charts were developed for use in under-fives clinics and so included the first five years (25). The WHO modification added the sixth year (18) and so emphasis has been placed on weighing all children under five or six, as in the case of the UPGK and ICDS programmes, respectively. In the Philippines, one programme monitors children up to six years, another for five years, and a third for only three years (30). In Thailand, the Ministry of Health programme spans five years (64). However, a growing group of professionals feel that it is adequate to weigh children up to the age of three only (52). This would halve the work load of weighing on the workers, reduce crowding at centres, and allow concentration on zero to threes who are most at risk of malnutrition. (In addition, space for other information would become available on the health card with the elimination of the chart for the fourth, fifth and sixth years).

Alternatively, older children could be weighed less frequently. Fajans and Sudiman have argued that after two years of age, the expected monthly weight gain of a child is less than 150 gm., which is close to the limits of accuracy of the weight measurement, and may be within the intra-individual variation (37). Thus, monitoring growth of this age group on the basis of weight gain over a period of *three* months may be more meaningful.

Other approaches to children over three are also reported. In a system devised by Christian Medical College, Ludhiana (Punjab), India, children over three are screened with the arm circumference tape and weighed only if their measurement is low (44). Indeed, it is commonly felt that the mid-arm circumference measurement is adequate for monitoring children over three years of age.

Fajans and Sudiman have further argued that beyond three years of age, children in the UPGK villages they studied did not change "categories" of nutritional status (37). (Two-thirds were in the "normal" range at the age of three while one-third were below normal); but only eight percent fell in nutritional status subsequently.) Furthermore, children over three are no longer

targets for immunisation, nor their mothers for feeding advice. Thus, they see no reason to continue these children in weighing programmes. In support, Agarwal has reported that children's attendance at clinics, which may be regular in the first year and at three-monthly intervals thereafter, becomes irregular after the third year. Health workers in the field may also not "bother" with children over three (52).

However, a high prevalence of malnutrition and illness may be observed among three to six year olds in certain situations (65) and the decision to monitor these children by periodic weighing may be taken in accordance with local conditions. An examination of growth charts in the ICDS blocks visited in Rajasthan and Haryana for this study showed considerable growth retardation among three to six year olds.

Given the demands on mothers' time, another factor that may discourage their attendance at centres is the time taken to weigh large numbers of children on weighing days. In the UPGK programme, around a hundred children may have to be weighed at the monthly session (37). Even if a minimum of two minutes (which is inadequate as we shall see) is spent per child, it means that some mothers might have to wait for two or three hours for their child to be weighed and to follow through the recording and education procedures. In the village where the number of weighing posts was increased, resulting in a reduction of children to be weighed at any one post, attendance increased. For this and other reasons, Fajans and Sudiman have suggested that not more than 50 children should be weighed at one post or one session (37).

In fact, time may be a major constraint from the worker's point of view as well, limiting the number of children weighed and perhaps also resulting in "selection". In the Indonesian programme, workers spend 40 percent of their time every month on weighing activities (and the remainder on home visits, primarily to motivate mothers to attend the weighing sessions!) These workers are unpaid volunteers and so the extent to which they "cover" their under-five population would depend on their zeal and the time spent on motivation.

Home-based monitoring: Programmes which require workers to weigh children in homes in addition to (or instead of) centre-based weighing may circumvent the problem of generally inadequate or selective coverage of children. At least in theory, all ages (within the target group), both sexes and children of all classes including those who live at distances from central points in villages are reached. In addition, children who are considered most needy may

be focussed upon, such as zero to threes, the poorest or, in some cultures, females.

Cowan has described a weighing programme that is primarily home-based, run by the Christian Medical College in Ludhiana, Punjab (52). The multi-purpose health workers in Sanewal block visit homes for 15 days every month covering 35 families a day and their entire population every two months. They visit every house but focus on homes with children under five and pregnant women and on very poor homes—where the majority of under-three deaths occur. They carry Salter scales on their home visits and weigh children under three. Those over three are checked with the arm circumference tape and weighed if they have a low arm circumference measurement. Thus, not many children need to be weighed each day. The act of weighing and the growth chart are “entry points” for other health interventions and health education of mothers.

While, in the UPGK programme, home visits are used primarily for motivation, in the ICDS programme home-visiting is advised also for weighing and follow-up of children. It was found, however, that, in actual practice, although workers did visit homes, they preferred to use the home visits to motivate mothers rather than for weighing. They admitted reluctance to carrying scales and charts with them on home visits unless a “helper” was available to assist them. As a reason they cited the fact that mothers or children are frequently not at home, that mothers did not want their children weighed, or that there was no place to hang the scale in homes. Thus, ultimately, they weighed only those children who came to the centres regularly and those whose mothers brought them in response to the worker’s pleas. Generally, therefore, one might conclude that, when growth charts/health cards are kept at centres, only those children who come to the centres or are brought by child-minders are weighed regularly.

2.4. COOPERATION OF MOTHERS

In both centre-based and home-based growth-monitoring, mothers’ compliance is a major factor limiting access to children for weighing, and besides being bound to the issue of “mothers’ time”, it is also related to the cultural acceptability of weighing. In many traditional cultures, weighing a child is viewed with fear or superstition. Workers in India report that, at the inception of a programme, there is invariably difficulty associated with getting mothers’ permission to weigh children, leave alone their *participation* in the process. One

to two-thirds of mothers would protest initially. New-borns and infants are particularly inaccessible. However, with time, continuous education, and "peer pressure" superstitions and fears of weighing may break down. Fears of the "evil eye" are dispelled (perhaps in as little as six months) (50) by the observation that no harm befell another mother's child after weighing and may be replaced by a desire to see whether one's own child is doing alright ("keeping up with the neighbours"). In due course, a mother may even "demand" that her child be weighed. Generally, however, while mothers may stop objecting to the weighing, they are not particularly interested in it. And there may always remain a hard core of five to 10 percent of mothers who hesitate to have their children weighed despite a worker's best efforts.

Arole has observed that mothers may need incentives to bring children for weighing, such as good MCH services and/or a nutrition supplement for those who are under-nourished (52). At Jamkhed, it was found that the compliance of mothers was proportionate to the health services being provided. Participation in the programme was high when workers were dedicated. The involvement of local village people, women's clubs or farmers clubs, in weighing, maintaining cards and giving health education has also helped to involve mothers at Jamkhed.

In the UPGK programme, several special efforts have been made to increase the participation of mothers (with their children) in the weighing programme (37, 38). The Health staff have attempted to coordinate mobile outreach health services with the weighing activities, but without positive results. A lottery was instituted for attenders but it has apparently not increased participation. When questioned, many mothers said that they attended weighing sessions to know their child's health (but many of these could not relate weight to their child's health status). A few mothers stated that they came to get the food supplement. Some said they went to the weighing sessions because they were told to do so by village leaders (37).

At the ICDS *anganwadis* visited in this study, few mothers were to be seen. As mentioned earlier, most of the children attending were older ones who were able to come to the centres on their own or were dropped there by family members. A few younger ones were in the care of older siblings. All the workers we interviewed said that the children came mainly for the food supplements; that more children would arrive when the food was usually served (around 11 a.m.), that many came just to collect the food and then left. The food supplementation in this programme is intended primarily for those children who are "Grade II" or below in nutritional status but the practice is to feed all children who attend the

centres. (Older siblings are often also included on humanitarian grounds). Unlike the UPGK programme where weighing and supplementary feeding occur on only one day in the month, in the ICDS programme food is distributed 300 days in the year, six days a week. Although weighing days are frequently specified, the workers could weigh children on any occasion that they attend the centre. On their home visits they can focus on the zero to three age group which has a low percentage of attendance and is nutritionally vulnerable. Workers report that when food supplies are erratic, attendance of all children at the centres falls drastically. (40).

Rohde (49) has suggested that mothers can be trained as “weight watchers” to “accept the prime responsibility to measure and interpret the progress of their child’s health”. The validity of this claim has yet to be tested out in large-scale operations under real-life conditions. Moreover, as Anandalakshmy (52) has pointed out, when mothers attain a level of motivation and competence that enables them to measure growth and interpret growth charts, then “growth-monitoring” as a public-health programme may become wholly unnecessary!

The unfortunate reality in many developing countries is that women of poverty-stricken communities are so overburdened with routine chores, such as fetching water, fuel or fodder and with work to earn their daily living, that they can hardly afford the time to visit health centres. A visit to a health centre may mean the loss of a day’s wages. The poor utilisation of health services—even of such inadequate services as reach the rural areas—is related to a large extent to poverty and not just to ignorance or apathy as is often made out. While women with proper motivation and education can certainly be helped to take better care of their infants and children at home, expecting them to participate in time-consuming operations would be unrealistic. On the other hand, there may be older women in the community not ‘burdened’ with young children and arduous house-hold chores who may be able to help in health programmes. It may be possible and desirable to enlist their services. However, health programmes predicated solely on voluntary labour are likely to be inadequate and ineffective.

2.5. TIME SCHEDULE AND FREQUENCY OF GROWTH MEASUREMENT

Growth-monitoring implies frequent growth measurements at regular intervals in order to assess growth trends. Frequency and regularity of repeat measurements is the essence of growth-monitoring. In actual practice, however, in addition to those not enrolled in weighing programmes at all, those who attend

may miss one or more months weighings for any of several reasons. In the UPGK programme, despite the 10 hours spent per month by the worker on weighing and motivating activities, many children were seen to have one or more blocks of three or more months about any weight record because of absence from the village (37).

In the ICDS blocks visited for this study, the workers usually assigned a specific day in the month to weigh the children at the centre. However, as many as 70 percent of the children enrolled at a given centre would not attend on the appointed day and so the worker would weigh others who came in the three or four days succeeding. At the ICDS *anganwadis*, it was observed that the act of weighing takes three to five minutes per child and more time in the case of children (or mothers) who require persuasion. Thus 10 to 20 children may be weighed in an hour if the worker is not called to some other business, if she is assisted by a helper, and if cooperation is high. To weigh those who did not come at all during this period, the worker was consigned to visiting homes. They could visit four or five homes in a day at most. Many workers — especially those who were most diligent about weighing — said that it would take them a week to 10 days (of part-time work — hence, we estimate about 15-25 hours) to obtain the monthly weights of the 100-200 children in their charge. From a brief examination of the records kept by *anganwadi* workers in the ICDS blocks visited, it appeared that about 20 percent of children were weighed every month without fail, the largest group, about 30-40 percent, would have been weighed about every two months or once in three months only. About 20-30 percent would have been weighed about every two months or once in three months only. Another 20-30 percent would have several months (even up to six months) of missing observations while the remainder, about 10 percent were never weighed. With the rare worker who was highly motivated, much higher levels of coverage were found (e.g. 90-95 percent) with regular monthly weighing. On the basis of observations in this study, it is estimated that the moderately well-trained and motivated worker obtains about six to eight monthly weight measurements on an average per year on a child enrolled in the programme. It is also estimated that to provide this level of coverage for a 100 children, a worker weighing children at the centre and on home visits spends a minimum of 20 hours per month on this activity.

At the UPGK centres, Fajans and Sudiman observed that 100 children were weighed over a three hour period in the "four table" system. With less than two minutes to weigh and record each child, the workers were rushed and recording errors were frequent. Thus they consider the time devoted to weighing as quite inadequate (leave alone that available for follow-up activities as we shall see later).

The difference in the time spent on weighing an individual child in the two programmes — i.e. two minutes in the UPGK and three to five minutes in the ICDS scheme — is instructive. On the one hand, a streamlined system such as that of UPGK permits “rapid” weighing. On the other hand, it involves four workers and errors are nevertheless frequent. The less organised ICDS system permits a more ‘personalised service’ but the worker is still overburdened as she has to perform all the steps of the weighing operation from lining up the children to plotting their weights on the growth charts. Despite the organisational differences, both programmes emphasise the act of weighing to the exclusion of education and follow-up activities.

Clearly, in the field, the frequency with which weights are taken on an individual child depends on a large number of factors: whether the child’s attendance at the centre is regular, whether mothers are motivated to bring their children for weighing during the period assigned by the worker, whether the worker is dedicated to the job of weighing all children monthly and persistent in her home visits, the difficulty of geographical and cultural access within a community, the size of the village and the target group, etc. Even under rigorous research conditions, frequency of weighing may be less than desirable. For example, in a study of child nutritional status in four Gujarat villages (68) which aimed to weigh 80 children for six consecutive months, only 34 percent were weighed all six times, 43 percent were weighed four or five times, and the rest (24 percent) were weighed three times or less. The implications of this for growth-monitoring on a large scale cannot be ignored.

Growth charts lose their value as tools for identifying high risk children unless weighing is frequent and regular. However, the ideal frequency of weighing depends largely on the reason for which growth-monitoring is being done. If a major reason is to identify the child at risk or in urgent need of attention, the weighing should probably be done monthly at least during those periods when high morbidity and mortality are expected. Some investigators feel that weighing every two months may be adequate after the first year of life (55). On the other hand if weighing is being done only to examine growth pattern and design long-term assistance measures *at a community, regional or national level*, three-to six-monthly weighing may be adequate. Programmes which employ village-based workers to do the weighing have generally adopted the monthly-weighing norm. For example, at Jamkhed, children are weighed monthly at a central place in each village, at a little “mela” at which informal community education takes place as mothers and others discuss the weighing and child health with health workers (52). The weighing takes place over three days

because of the distance of certain hamlets and is usually done early in the morning before mothers go to work. On the whole, Arole feels time is saved by his method over weighing in individual households. However, variations may occur. In the Community Health and Development Programme of the Christian Medical College, Vellore (Tamil Nadu), children are weighed once in six months in the field but monthly at creches and when mothers bring children to the fortnightly mobile-clinics (53). However, under these circumstances mothers tend to come only when immunisation is required or when the child is ill. Patowary reported a frequency of every three months for weighing in the rural ICDS block near Guwahati (52). A small programme using growth charts for nutritional surveillance in Thailand (67) used a graduated system. Children from 0-18 months were weighed every month, those from 19-36 months were weighed every two months, while those between 37 and 60 months were weighed every three months by a village-level field worker.

The worker can focus on the younger group because of their higher nutritional risk, weighing them every month but children between three and five years could be weighed every three months only because of the slower weight increases of this group and better nutritional status.

One rationale advanced for maintaining a monthly norm is that this at least ensures that the primary level worker will try to obtain every child's weight every *two* months! These facts suggest the importance of having a worker who actively seeks out children for weighing, especially until the programme is established to the point where mothers value the taking of their children's weights and come to the centres regularly.

The above observations underscore the fact that regular and frequent weighing is a time-consuming operation which would occupy health workers for several hours every month. Where the availability of trained manpower is good, this may not be a serious drawback; but where this is not the case (as in most developing countries), this may be a major consideration in the adoption of growth-monitoring on a large scale. In the UPGK programme (which is a special time-bound programme with inputs of an order that cannot be continuously afforded by most developing countries) as many as four health workers are simultaneously engaged in the 'four-table' chain of growth-monitoring operations. The fact that such workers are "volunteers" must not obscure the 'costs' of growth-monitoring operations. The time spent by these workers does have its opportunity costs. Requiring communities to provide free or low-cost "voluntary" labour for health service provision is tantamount to "double taxation" of the poor (while the rich continue to avail of subsidised health care).

2.6. ALTERNATIVE METHODS OF GROWTH-MONITORING

Weight-for-age is sensitive to small changes in nutritional status and the measure is regarded as “objective and repeatable” (32). However, to fill in weight-for-age graphs, field workers must be literate, age data which may be deficient are involved, and there may be cultural barriers to the weighing of children, among other factors. Thus experience with weight-for-age charts and the several problems and constraints involved in their use has given rise to suggestions for simpler and more feasible alternative methods of monitoring growth. The search has been for a *simple* method of assessing nutritional status which village level health workers can easily use, and which will be much less expensive. Age-independent growth measures have been considered preferable.

The monograph on growth-monitoring produced by the American Public Health Association advocates that the choice of method should be made in accordance with programme goals, the type of population being measured, and the programme's resources (32). For example, the measure chosen should depend on what the growth data will be used for, what the nutrition profile of the area is, what level of training is required for health workers, what cultural factors influence the measurement and the follow-up, and what time, equipment, and finances are available for the growth-monitoring component of the programme. This study rates weight-for-age and arm circumference measurements most highly in their ability to fulfill utility, feasibility, reliability and sensitivity criteria, with arm circumference faring better on ‘feasibility’, but less well on the other three criteria.

Fisher (68) has proposed that the mid-upper arm circumference measurement is the easiest and cheapest to make and a good alternative to weighing. A simple measuring tape is all that is required and plotting difficulties are avoided. In a sample of Zambian children, arm circumference measurements correlated closely with weight, height and triceps skinfold measures. He cites the expense of weighing scales, the inaccurate recordings by auxiliaries, and the insensitivity of height to growth faltering as the reasons for preferring the arm circumference measure to weight or height-based measurements. A value of 15 cm. from the age of seven months is suggested as the cut-off point below which advice on feeding and health care should be given.

From a field study in Congo (69) the percentages of malnourished children

detected by arm circumference and weight-for-age can be compared. The former method consistently showed higher percentages of children as moderately and severely malnourished when cut-off points of 13.5 cm. and 12.0 cm. were used, compared with 60-80 percent and under 60 percent of the reference weight-for-age respectively: 42.7 percent of children under three years were found moderately malnourished by the arm circumference measure, compared with 25.7 percent by weight-for-age. The percentages for severely malnourished children were 6.8 and 1.0 respectively by the two methods. The investigators concluded that the arm circumference measure was useful and adequate for the nutritional surveillance of young children.

A large scale evaluation study conducted by the (Indian) National Institute of Nutrition established a similar trend (70). Weight and arm circumference measurements were obtained on 38,000 children. It was found that the percentage of "moderately" malnourished children detected by the Gomez classification (less than 75 percent of the standard weight-for-age) ranged from 26 to 30 while by the arm circumference (under 13.5 cm.) it was about 50 percent. Prahlad Rao (70) has cautioned that these cut-off points may not be comparable as each is arbitrary. "Comparability" must be established with reference to a third (dependent) variable which has physiological significance, such as functional impairment. This is clearly brought out by the fact that the other studies may show the *opposite* trend from that noted above. For example, Vijayaraghavan and Sastry (71) show that arm circumference measurement may "miss" a considerable proportion (18.5 percent) of children with weights for age below 85 percent of the standard.

Experience in the ICDS programme has indicated that *anganwadi* workers are unable to completely cover the large number of children in their charge with weighing. Consequently, the decision has been taken to use mid-arm circumference measurement as an initial screening procedure (74). Only children selected on this basis will be taken up for growth-monitoring using the weighing technique.

The ICDS programme uses an arm circumference tape marked as follows: "red — under 12.5 cm. — denoting severe malnutrition; "yellow" — 12.5 to 13.5 — moderate malnutrition; and "green" — over 13.5 cm — good nutrition.

Measurements are proposed to be taken every three months and the child's "colour" recorded in a register. There is, as yet, insufficient experience in this programme of this method on which to base a judgement. However, we noted

that some tapes in use did not have appropriate markings, which is likely to cause confusion among workers.

A drawback of mid-arm circumference measurement is that it cannot be applied to infants (below one year) since the measurement changes rapidly during infancy to reach a relatively stationary level at around one year. In order to get over this limitation, Echeverri (73) has developed a tape for measurement of the mid-arm circumference of infants in three different age groups — zero to three months, four to seven months and eight to 11 months. This device is a single reversible strip; there are separate markings for each age group. “Severe” and “moderate” malnutrition correspond to measurements under 10.5 and 12, 12.5 and 14, and 13.5 and 14.5 cm. respectively for the three age groups. We find it simple and suggest that it is capable of being used by field workers after minimal training. However, reactions of workers to this innovation do not appear to be enthusiastic. It is felt that the need for three different codes for infants and another strip for children over one year of age makes a mid-arm circumference measure too complicated for the average field worker. Robbed of simplicity, its preference over cumbersome weight measurements may not be justified. In our view, however, even with all the refinements proposed above, mid-arm circumference measure is far less complicated than the weight-for age chart.

The validity of the cut-off points for the different age groups suggested by Echeverri may need verification. While we realise that a judgement on the practicability of this innovation must await further field experience, it could be a useful innovation which would greatly simplify growth-monitoring. The worker will need just two strips, one for infants and another for children between one and five years. The usefulness and sensitivity of this technique may be enhanced if, besides the colours now used to depict different levels of undernutrition, the strips are actually graduated in centimetres. Nabarro has observed that a decrease of 0.5 cm. in mid upper arm circumference is accompanied by a fall in weight of one kg. and vice versa (74). Detailed studies to establish such a correlation between arm circumference and weight changes are in progress in Nepal (75). The determination and recording of actual circumference measurements can help to monitor changes over time by showing whether a child who continues to be in the same colour zone is improving or not. Cards to record repeated arm circumference measurements are available and may be useful.

Weight-for-height has also been considered a useful measure when age information is inaccurate or when serial weight measurements cannot be taken. Nabarro (76) asserts that it is not feasible to weigh more than a small number of

children regularly. He cites the prohibitive cost of scales if they were to be provided at village centres, the time required to teach primary level workers to weigh and plot, the problem of ensuring continuous, regular supervision by higher level staff, and the lack of access of infants, children of deprived families and of working mothers who do not attend centres and whose weights are therefore difficult to record regularly. With those who attend centres infrequently, Nabarro has suggested that weight-for-height may be a preferred measure, and devised a weight-for-height wall chart (Thinness Chart) for his purpose (33).

Nabarro and his colleagues worked in an area of East Nepal where a high proportion of children appeared to be stunted. These children were deemed not to be in an urgent need of nutrition intervention as those who were wasted. This decision was based on the presumption (which is not adequately supported by data) that wasted children are at greater risk of illness and death than stunted children, and also on the notion that the former are more easily rehabilitated. Actually measuring wasting requires weight-for-height assessment which is difficult for illiterate workers to perform because accurate weight and height measurements must be taken and a mathematical calculation must be performed. Only workers with a high level of education could do this. The calculation step is eliminated by the wall chart which allows a direct "reading" of the range in which the child's percentage weight-for-height value falls. Thus all that is required is an accurate weight reading. A child is weighed and then made to stand against the wall chart in front of the column for his weight (columns are shown for every 0.5 kg.). The colour area of the chart upto which he reaches in height is then noted. From top to bottom on the chart there are three areas — red, yellow and green denoting low weight-for-height i.e. wasting (70-80 percent of the reference weight-for-height); moderate weight-for-height (80-90 percent), and acceptable weight-for-height (90-110 percent). (NCHS reference data have been used). While on the weight-for-age chart an "upward" movement is desirable, on the weight/height wall chart, the higher a child in any weight column, the worse is his nutritional status. This could confuse the worker.

Brabin *et al* (77) conducted a small study of the extent to which weight-for-age charts were being used successfully to identify wasted children by nurses at under-fives clinics in Kenya. The investigators identified wasted children themselves using the weight-for-height wall chart. They found that 43 percent of children who were wasted (in the red) according to the weight-for-height chart, were not identified by the nurses as in need of any nutritional intervention; and only 14 percent of those who were at risk (i.e. wasted or becoming wasted according to two successive measurements) were referred. They then investigated the possible reasons for this. 25 percent of the children at risk had

either lost their cards or had poorly recorded cards; the remainder had not been referred because the nurses had failed to recognise poor weight gain among these children on their "Road-to-Health" cards. They concluded that the weight-for-height chart may be useful for accurate nutritional assessment.

However, when studying the feasibility of using the weight-for-height chart, these investigators found that although nurses could take the measurements easily they had difficulty recording weight-for-height measurements on the record card (which is necessary for longitudinal monitoring) and interpreting them. Thus, they concluded that although identification of wasted children may be more accurate with the weight-for-height chart, it did not offer any special advantages compared with the growth chart in terms of feasibility.

Several operational problems with the weight/height chart have been noted (56). The chart requires a level floor and smooth walls which are not always available in villages. It is difficult to get small children to stand as erect as is required to get an accurate height assessment. Two workers are required to do this. In addition, when several children are to be measured, weight must be taken at a scale by one worker and communicated to the workers at the chart. Fajans and Sudiman (37) feel that the collection of height data in addition to weight is not wise or necessary. It would increase the time spent on data collection and supervision and perhaps decrease coverage, increase error, and would increase costs on equipment. In our opinion, these problems render the weight-for-height chart logistically difficult to use. In any case, we are *not* in agreement with the basic premise underlying the use of weight-height measurements: that only wasted children should be selected and stunted ones eliminated. Correlation between weight-height and height-for-age is poor (75) and a considerable proportion of children who are normal weight-for-height may be "nutritional dwarfs" (low height for age). According to data from the (Indian) National Nutrition Monitoring Bureau, as many as 40 percent of children may fall into this category while only 30 percent would be low weight-for-height (79). Stunted children could "catch up" on growth if provided proper health and nutrition services. The factors that cause stunting could themselves predispose a child to illness and death, and that child may be in as much need of nutritional surveillance and health care as his wasted counterpart. Furthermore, stunting has generational consequences (stunted mothers bear low birth weight infants) and, therefore, cannot be ignored.

3. Use of Growth Chart Data — Review of Experience

3.1. INTERPRETATION OF GROWTH MEASUREMENTS

Weighing children and recording their weights on growth charts are not ends in themselves. The process will have no meaning unless the data so laboriously collected lead to positive action resulting in the promotion of child health and nutrition.

There are several ways in which growth data are interpreted. One mode of interpretation is simply to compare the child's weight at any particular age with the "desired" weight for that age. The extent to which the child's weight falls short of the desired weight is the severity of his or her undernutrition, and the child is placed in a "grade" according to arbitrary previously defined norms. For operational purposes, these grades are generally numbered (1,2,3,4) or represented by different colours or shades on the weight chart. Thus, workers (and mothers) may be taught that a particular numerical grade or colour represents danger (e.g. Grade II or yellow) or extreme malnutrition (e.g. Grade III and/or IV or red). A child may appear healthy to the mother or even a health worker, but measurement of her weight and comparison with the standard could reveal I and II degrees of growth retardation which are not apparent. Indeed, mild undernutrition is often missed. Under the circumstances, growth-monitoring could provide "early warning signs" which the worker is expected to heed to prevent the child from deteriorating into more severe malnutrition. This, in fact, is the ideal use to which growth-monitoring data are expected to be put. However, in actual practice, many growth-monitoring programmes are targeted only on the severely malnourished and workers are advised to concentrate on those who fall "below the red line". In such programmes, the objective of 'early detection' of undernutrition is lost sight of and mild undernutrition is almost accepted as "normal". This is most unfortunate as it reduces growth-monitoring

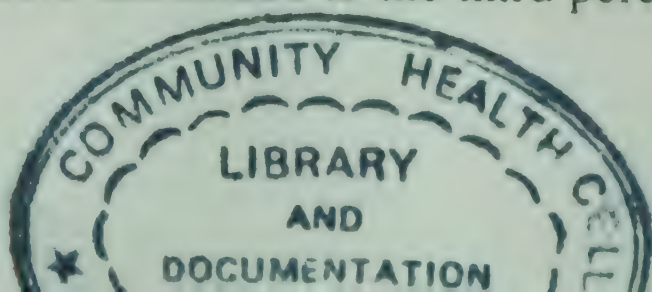
from being the 'preventive' operation it is intended to be to a purely 'curative' programme for those identified as moderately or severely malnourished.

Slope of the curve: Morley has stressed that the place of the growth chart where a child's weight falls at any given point in time is less important than the *changes* in his weight (17). Thus, the slope of a child's growth curve relative to the reference curves on the chart is more important than his actual weight. Here, the diagnostic criterion is *the velocity* of weight gain, reflected in slope of the weight curve. A slowing in growth velocity is represented by a flattening curve while a loss of weight is shown by a decline in the curve. An intervention is urgently called for not only to avoid a precipitous fall into a lower grade of malnutrition, but to prevent further weight loss and, in fact, to put the child back onto an upward growth trajectory. In the case of a child whose weight is already below the standard, it should not be considered satisfactory if the slope of his growth curve continues to merely parallel the standard. In such a case, what is needed is "catch-up growth", reflected in a steeper upward slope of the growth curve. Unfortunately, in growth-monitoring operations, little attention is currently being paid to the slope of the growth curve, and the possibility of catch-up growth seems to have been totally written off.

Weight gain: Weight gain in a child differs at different ages. An examination of the mean reference curve on a growth chart will show that the first five years may be divided into periods of differing weight gain velocities. In the first six months, the mean weight increases by about 500 gm. per month. Thereafter, up to 18 months, an average increase of 300 gm. per month occurs. Between 18 and 36 months, this rate is halved to 150 gm. per month, and further diminishes to about 110 or 120 gm. per month up to five or six years of age.

These relationships have been used as the basis of the "weight gain" method of interpreting growth data (27). This method examines a child's absolute weight gain over a month or more and relates it to the desired gains, without referring to the child's nutritional position vis-a-vis the reference population. If a child is gaining weight at the appropriate rate it is considered "healthy" (albeit "small"). The 'weight gain' and 'slope of the curve' methods are not identical as is sometimes presumed. In the latter, emphasis is placed on a child's growth curve being parallel at all times to the reference curve so that the child's status in terms of 'percent of standard' remains unchanged. On the other hand, with the weight gain method, the child may continue to gain some weight but yet be falling in nutritional status (defined as 'percent of standard'). For example, a three month old child weighing 4.5 kg. (above the 50th percentile) may show a weight gain between 100 and 200 gm. monthly but have descended to the third percentile

3775
NUT100



(severe malnutrition) by age one year.

Emphasis on 'weight-gain' or slope of the growth curve should not serve to under-rate the importance of the *actual weight* of the child. Both criteria — actual weight and velocity of growth (slope) — are important. Exclusive emphasis on the slope of the curve or weight gain to neglect of the actual weight could well mean subscribing to the "small but healthy" hypothesis. Small babies growing apparently well in a growth trajectory considerably below the reference standard would end up as stunted adults. This question has been discussed in detail elsewhere (80).

A composite interpretation method for the weight curve has been suggested by Steveny (81) to enable health workers to detect children whose growth is deficient and to give their mothers relevant advice. According to him, under four months of age a child's absolute weight gain is relevant — it should be around 500 gm. per month, failing which the cause is most likely to be inadequate breast-feeding and the intervention should be advice to the mother to improve breast-feeding of the infant. From four to six months a weight gain of a quarter kilo per month is desirable. Anything less indicates the existence of a problem which requires investigation, regardless of where the child's weight is to begin with. During the critical period of six to 15 months more sensitive criteria are called for. Three successive measurements that show either a flattened or falling weight — even if they are in the "normal" range — is cause to investigate for illness in addition to inadequate feeding. Following advice and treatment, the child should be watched until an improvement is manifest. In the 16 to 60 month period, the danger signs which call for intervention are three flat or falling weight measurements below the third percentile and a loss of one kg. or more, or any position more than two kg. below the third percentile. These arbitrary criteria are, however, debatable.

Thus, complete interpretation of the growth chart is subtle and complex. A health worker requires a fairly sophisticated knowledge of growth dynamics, and the relationship to health and feeding and illness, to utilise the range of information provided by a child's growth curve. Weight curves identify children at risk. A loss in weight helps to detect illness and possible fatality. A child who is ill or being neglected (especially during infancy) is at risk of death and needs to be picked up quickly. Poor weight gain in successive months indicated by a deviation from the expected slope of the weight curve, signifies a health problem requiring diagnosis and management. Malnutrition must be prevented, diseases curtailed and growth promoted through appropriate and timely interpretation and intervention.

However, in the field, this level of sophisticated interpretation is difficult to achieve. All the information assembled in this study indicates that it has, in fact *not* been achieved in any growth-monitoring operation. Thus the greatest potential benefit of the elaborate growth-charting process is, in actual practice, not being realised.

In the ICDS blocks visited for this study, it was found that the workers were solely concerned with the child's grade of malnutrition. The charts in use had reference lines, demarcating "normal". I, II and III (and a few had IV) grades. Even when cards were not marked or, as in one case, wrongly marked the worker knew the grade areas correctly. Invariably, a child's nutritional status was diagnosed according to the position of his last weight measurement. It was observed that frequently workers did not connect the dots of serial weight measurements. This also suggested that they examined only the position of the latest dot and not the curve formed by joining successive ones. When workers were asked to explain what a particular chart demonstrated, they simply gave the child's nutritional grade. However, when asked how they would interpret two measurements together they responded that they look for a fall in weight. A low rate of weight gain was *not* considered especially significant. As long as some weight was gained it was considered satisfactory. Asked to interpret a flat line, they would say, "the child is not growing well", but few workers considered this a problem in itself requiring investigation regardless of the child's grade! They were, however, cognisant of the significance of a *drop* in weight and usually investigated these occurrences. "The child is not getting enough food" was the main explanation given, but fevers, diarrhoea, etc., were also mentioned in this connection. However, a decline in weight was considered highly significant when the line crossed into Grade III, because at this point the child qualified for a double food ration according to the "project rules". A fall into Grade II is significant because the programme calls for supplementation of these children: but in actual practice, *all* children attending centres receive a food ration regardless of grade of malnutrition because of the obvious difficulty of turning away some children who come all the way to the centre while feeding is in progress. The worker is not called upon to deliver the supplement to the homes of those children in grade II who are not regular attenders. Thus the identification of "moderate malnutrition" through weighing and growth charting does not result in any specific action, that would not have been taken at the centre without growth-monitoring. Thus, the only purpose served by the entire growth-monitoring operation is the identification of severe malnutrition cases which qualify for double-ration. The objective of early detection of growth retardation is lost sight of.

In their study of growth-monitoring in an ICDS project in Gujarat, Patel

and Gopaldas (82) found that *anganwadi* workers who had been initially trained for four months and retrained for a day a few weeks before the study, were able to weigh children fairly accurately and plot the weights accurately on the growth chart (their weight recordings were actually rechecked a day after by the investigators). However, their ability to interpret their findings was limited. While they were able to identify the 'grade' of undernutrition, they failed to comprehend the significance of stationary body weight. As many as 35 percent of children in the group investigated by them, whose growth had been monitored by the *anganwadi* workers, failed to register increases in body weight in three successive weighings, and yet these children had been "totally ignored as not needing any advice". Where, however, the child had actually *lost* weight, this was taken note of. What was disconcerting was that not only the *anganwadi* workers but their supervisors and the auxiliary-nurse-midwives also had such inadequate comprehension of the interpretation of growth charts. It must be added that the workers studied by Patel and Gopaldas were a highly selected group of 'well-trained' workers "ready to cooperate". They had a fairly high basic schooling level having passed out of secondary school, on the top of which some of them also had a "diploma in Montessori training". These investigators had eliminated from their study ICDS centres where weighing was obviously being done in an unsatisfactory manner, where facilities for hanging balances were not available, etc. (Incidentally, according to these workers 15 percent of *anganwadis* "may not have facilities to hang Salter scales properly"). Even with such deliberate selection, the performance with respect to interpretation of data was poor. It is possible that here the blame has to be laid at the door of 'training'. Apparently the workers were only trained to identify the "grades" and no more. It was probably felt that to clutter up the training of "low-level" workers with too many subtleties may prove counter-productive; or perhaps the training itself was so tailored as to select only a small number of beneficiaries who could be handled with the resources available.

Similarly, Vijay Kumar reports that *anganwadi* workers in an ICDS block near Chandigarh can pick out severely malnourished children but are not concerned with the child who has a flattening curve (46). Thus, the growth information is used to identify and "treat" established malnutrition rather than detect early growth faltering, and nutrition-infection relationships are completely missed.

In Indonesia's UPGK programme too, there is concern that the workers are not able to identify malnourished cases adequately (38). The accuracy with which children's nutritional status is classified is apparently poor. Fajans and

Sudiman report that while workers understood the concept "below the red line", only half knew of the three-consecutive-months-no weight gain criterion for giving mothers advice and a referral to the health centre (37).

The question of interpreting the growth curve does not arise when there is a scarcity of growth charts as was found to be the case in the ICDS programme in Rajasthan. Here, the worker entered weights into a register and simply checked them against a chart to see what grade the child was in.

On the other hand, the "weight-gain" criterion is also being used in some programmes in a manner which is likely to *exclude* a number of really undernourished children. An example of this is the World Bank-assisted Tamil Nadu Integrated Nutrition Project in India (27). While we generally welcome growth-monitoring programmes as an exercise designed for *early detection* of the undernourished, the World Bank project uses growth-monitoring to rigorously select only the indisputably undernourished even if in this selection process, several needy children are excluded. Weighing is done monthly on all children under six years of age in the project areas. The basic premise in the 'no-weight gain' or 'low-weight gain' strategy, as it is used in this programme, is questionable. While a normal child between six and 11 months of age gains weight at 500 gm. per month, between 12 and 14 months of age at 200 gm. per month, and between 15 and 35 months of age at 167 gm. per month, the programme lays down that a weight gain of 300 gm. per month during the six to 12 month age period, and at 100 gm. per month after this period, may be considered quite adequate, because according to the sponsors of the programme, a child that is malnourished (first to third degree malnutrition) and gaining weight at these lower level "*will still maintain his or her nutritional status quo*" (ref: TINP Plan of Operations — Annex. 6, page 1). Thus the objective is just to ensure that children in moderate grades of undernutrition, with body weight deficits up to 40 percent of the normal expected standard weight remain in that grade and do not sink further down into the more severe Grade III: the strategy in the programme clearly does *not* provide for children in moderate grades of undernutrition to move up to the normal grade. Children between six and 11 months who did not gain any weight in the previous month or gained less than 300 gm. for two consecutive months are selected for supplementary feeding. Children between 12 and 35 months are selected if they have lost weight over the previous three months. If a child in this age group has gained less than 300 gm. in the previous three months he is considered 'at risk'; he is *not* selected until his next month's reading confirms that low weight gain has persisted over the three months prior to the second weighing as well. In other words, the three-month-no-weight-gain must be 'reconfirmed' before the child 'qualifies'. In both age groups, an additional "disqualification" is diarrhoea in the previous week

(because weight loss "is to be expected" after such an episode and is "presumed to be transient") following which the health worker is instructed to weigh the child again a week later and apply the appropriate criterion.

The emphasis is on ensuring, beyond any doubt, that weight gain has been grossly inadequate and "not just a temporary phenomenon or a measurement error". It is also assumed that nonintervention in the case of a child with no weight gain or inadequate weight gain for three months will do the child no harm. The objective is to pick up only children with "long-term trends of inadequate weight gain". This is quite different from the notion of *early* detection of growth failure which is stressed by Morley and other proponents of the growth chart, where even a single month's flattening of weight is cause for concern if the child is in a sub-optimal category.

According to the probability tables provided by the sponsors themselves in their "Plan of Operation", with the implementation of this strategy, a child aged six to 11 months who has gained only 300 gm. per month for two or more months (compared with the 500 gm. that is desirable) will be excluded 22 percent of the time. Only if the child has gained no weight at all for two consecutive months is the probability of "selection" close to 100 percent (0.97). While the desirable monthly weight gain of children between 12 and 35 months is around 500-600 gm. every three months, the probability table shows that 22 percent of children gaining an average of 400 gm. per three months would remain excluded from the programme even after 23 monthly weighings (i.e. at the end of the third year of life). 24 percent of those gaining only 300 gm. per three months would remain excluded from the programme until after six monthly weighings (up to age 18 months) and 19 percent and 17 percent of those gaining only 200 or 100 gm. would be excluded for four and three months respectively.

The insistence on low weight gain for two or three *consecutive* months before the child "qualifies" will contribute to the exclusion of many needy children. It is well known that monthly attendance in weighing sessions, especially of the sick and malnourished children is irregular. Because of this, many malnourished children may not be picked up at all till they reach the qualifying grade three stage of severe malnutrition.

We do not have reports on whether workers in the TINP programme interpret growth data accurately enough to satisfy the complicated "selection procedure" laid down in the Project. However, field observations elsewhere may be relevant to this procedure. Reports from Indonesia state that workers can

usually pinpoint a child in a low grade of malnutrition or below a danger line, but have difficulty interpreting intermediate levels and understanding the concept of low weight gain.

As between the 'no-weight gain' criterion as it applied in the UPGK in Indonesia and TINP in India, Underwood (84) favours the Tamil Nadu method which sets different levels of desired weight gain for children between six and 12 months and those between one and three years, with the modification that older children who have gained less than 100 gm. in one month prior to the weighing should receive dietary counselling (but included in supplementary feeding only after three months of low weight gain (less than 300 gm.). However, in our opinion "less than 100 gm." is within the measurement error (instrument and investigator errors) of weight recordings.

A weight gain selection method without reference to where the child is in terms of nutritional "grade" at the time of weighing and without attention to whether there is gradual change (i.e. decline) in the slope of that child's weight curve, may be grossly inadequate. A child can already be moderately or severely malnourished by the age of six months if breast-feeding and child care had been inadequate and the infection load was high. At this critical juncture, a zero weight gain in any one month or a short-fall of 400 gm. in weight gain over two months could precipitate severe illness. Similarly the criteria applied to children between one and three years of age would appear to be too drastic. The disqualification based on having had an episode of diarrhoea is even more serious, as such an attack may precipitate severe malnutrition if it is not fatal.

In short, the strategy adopted in the World Bank-assisted Tamil Nadu Integrated Nutrition Project is in consonance with the "Nutrition Policy of Brinkmanship". At best, it can be used to identify "beneficiaries" — that is, those who are so severely undernourished as to leave no doubt about their undernutrition — for supplementary feeding as part of a repair and relief operation. It should not be a model for growth-monitoring operations designed to promote child health and nutrition.

Indeed, even the ethical basis of an operation which deliberately ignores children who have failed to gain adequate weight for three months in succession but which only takes note of those children *after* they have qualified for notice by "proving" their poor status in a fourth monthly weighing is questionable.

Some basic considerations: In the interpretation of growth data and growth charts the following basic considerations must be borne in mind.

1. The inherent limitations of growth measurement as an indicator of the severity of undernutrition, especially when applied to *individual children as against whole communities*, must be appreciated. Because the reference curves are derived from cross-sectional population based data, the degree of growth retardation in a child may not always be strictly equivalent to the severity of undernutrition.
2. The growth process cannot be expected to be equally sensitive to deprivation of all essential nutrients. Thus, growth may be expected to be more highly sensitive to energy-protein undernutrition than to iron deficiency, vitamin B complex deficiency, or vitamin A deficiency. Thus while a close parallelism between growth-retardation and energy-protein undernutrition may be expected, it may not be justifiable to expect the same degree of parallelism between the degree of growth-retardation and the degree of some other nutrient deficiencies. While energy-protein undernutrition is undoubtedly the most important nutritional problem among children of poor communities, other nutrient deficiencies also often coexist in the same population groups.
3. The 'grading' of the severity of undernutrition and the precise cut-off points that have been proposed (and are reinforced by colour schemes) for this purpose are wholly arbitrary and have no proven physiological validity beyond *estimates* of mortality 'risk' for a population (and these may vary for different populations). They can, at best, be justified only on considerations of practical utility for the purpose of programme management in the context of resource constraints. These and other limitations and fallacies that underlie the current "classifications of undernutrition" on the basis of growth retardation have been discussed earlier (21).
4. The genetic potential for growth of a given child may be anywhere within a normal range. Under the circumstances, a "growth deficit" of the order of 20 percent of the reference standard (50th percentile) may mean no more than mild undernutrition in a child whose genetic growth potential corresponds to the third percentile of the normal range but could mean moderate (or even severe) undernutrition in a child whose growth potential corresponds to the 97th percentile. Where growth measurements are applied to draw conclusions with respect to nutritional status of whole (homogeneous) communities of children, these limitations of growth measurement may be largely neutralised and 'ironed

but', but where they are applied to individual children, considerable caution will be necessary in the interpretation of data.

It would appear from a scrutiny of the published and unpublished reports on the use of growth charts and from the observations in this study that these considerations are hardly appreciated even by project leaders — let alone field workers. The cut-off points and colours are invested with a significance, precision and exactitude which they do not possess. In the interpretation of growth charts, it is still important to look at the whole child, his activity and alertness; to take note of the history of infection, dietary history and family environment; and to exercise judgement based on commonsense and experience. The growth chart is only an inert tool, the efficacy of which will depend on the user. Its proper use involves accurate gathering of information regarding the other items included in the health card. Indeed as much care is necessary in this effort as in growth measurement. This could incidentally also help mitigate the effects of inaccurate weighments. Unfortunately, however, it appears that, generally speaking, where growth-monitoring operations are in progress, the weighing exercise takes up most of a worker's time to the neglect of gathering information on other items and the provision of other services including advice to mothers.

3.2. FOLLOW-UP ACTION

For the purpose of deciding appropriate action following on growth-monitoring the information provided by the growth chart must be judged in the context of the total environment of the child, his family history, dietary history, and history of illness. This latter information is provided for in the health card; but quite often in the anxiety to conduct and complete the weighing operation, health workers do not pay (or do not have the time to pay) adequate attention to such important information needed to decide action.

Neither regular weighing nor correct recording and interpretation of weight will by itself ensure the child's health. The weighing must be done in the context of other health measures and the health card can indicate when these measures need to be taken. The collection of children at a centre for weighing could itself provide opportunities for other health interventions but these "opportunities" are at present not effectively availed of because of time constraints, lack of adequate additional information, lack of adequate training, the high "noise-level" at the weighing *melas* which rule out relaxed counselling and individual attention. This results in a distorted sense of priorities in which "means" are confused with "ends". One of the most common services provided along with

growth-monitoring is supplementary nutrition. (Giving away food supplement also helps to draw children to centres where they can be weighed, though Cowan (44) has shown that this 'bait' is not necessary.) Besides nutritional supplementation, health and nutrition education is frequently mentioned as an important service. Mothers are expected to be advised — at centres or on the workers' home visits — on how to feed the child with a slow weight gain or a flat curve. The growth chart could be a useful tool for this intervention if workers show and explain it to mothers so that they understand it. Other services that are frequently provided are immunisation, health examinations, or family planning advice and assistance. For high risk children, a system of referral to the appropriate level of health care may be built in. However, it is wrong to assume that monitoring itself implies that these other interventions in a programme are being fully or even adequately utilised.

Clearly, the value of the growth chart increases as more services are "piggy-backed" onto growth-monitoring. Indeed, when other services are provided alongside growth-monitoring programmes, their coverage and reliability may improve.

Unfortunately, however, wide gaps remain between the objective of utilising growth charts for health-related action and its implementation, particularly in large-scale programmes. We have, however, the experience from some special small-scale projects which provide valuable insights into how growth-monitoring operations could be carried out among poor communities with a view of really *promoting* child health and nutrition.

The Ludhiana Project: Cowan (52) has described the system introduced into the health structure of Sanewal block in Punjab by the Christian Medical College, Ludhiana. The state of Punjab has a well-developed health infrastructure. Each block has 17 Subsidiary Health Centres for a population of 100,000, with an M.B.B.S. doctor and a male and female Multipurpose Worker. For every four Subsidiary Health Centres there is a Lady Health Visitor. The staff of the medical college viewed their role as one of activating the existing health system. They introduced "family folders" of which growth charts are a part, and a home-visiting system that has been described earlier.

The Multipurpose Workers look upon weighing not as an end in itself but as an "entry point" into the family. It enables them to give health education and decide on other interventions required. The child is assessed and then weighed by the worker. A child whose weight is rising requires no further action. If a child

is losing weight, the worker investigates what the child is eating, with emphasis on quantity. The mother is advised if the child's diet is inadequate to provide it more from the family food. The programme does *not* include the use of food supplements. For children under six months, the emphasis is on breast-feeding and the mother is advised to improve this if the child's weight is not increasing appropriately (i.e. the curve is flat in the first three months). Cowan states that a slowing of weight would never be noticed if it were not for regular weighing from two months of age. It is mandatory up to 18 months, with the arm circumference strip being used beyond this age.

Cowan feels this system could be extended through the *anganwadis* of a nearby ICDS block, particularly to focus on children under three, and make the ICDS programme more effective. However, close supportive supervision is required and this is currently being provided by the medical college staff.

Special attention is paid to those households who would otherwise rarely utilise the health system or follow advice given. High risk cases are identified and followed. In addition to improving nutritional status, this system of "total family care" has increased immunisation coverage and even improved family planning performance. The family folders are considered a central tool in this service programme both for the MPWs and for follow up by doctors. It will be noted that in this model, growth-monitoring is not used to *identify* high-risk children. They are already identified on the basis of available information on the community. Growth-monitoring is applied to these high-risk children in order to detect early growth faltering and to prevent undernutrition and promote their health. This is, thus, truly a child health and nutrition promotion activity and probably represents the ideal way in which growth-monitoring can be used.

The Jamkhed Project: At Jamkhed, the monthly *mela* at which weighing is done is also used to deal with leprosy, tuberculosis, disability and family planning problems (52). The weight information is used to identify children with tuberculosis. If a child is not gaining weight, TB is suspected and appropriate screening is done. Children with measles are monitored, and diarrhoeal episodes are "treated" with oral rehydration salts. These timely strategies have led to a 50 percent drop in the number of children losing weight.

The Vellore Project: In the Community Health and Development Programme of Christian Medical College, Vellore, the growth chart has been used to identify high risk children for nutrition rehabilitation as well as primary health interventions and the programme has been able to reduce severe

malnutrition from eight to two percent of its child population (53).

Experience in ICDS blocks: In the ICDS scheme, in addition to growth-monitoring the village-level worker is entrusted with simple prophylaxis such as Vitamin A, iron-folic acid, deworming tablets and oral rehydration salts. Besides these and the nutritional supplement that is central to the programme, the worker is expected to counsel mothers and refer children in need to the next level paramedical worker, the ANM or MPW.

In actual practice, however, it was found that the workers linked the growth information primarily to the provision of the food supplement. The workers felt, without exception, that weighing the child was essential to determine what his or her nutritional status is and whether he or she qualifies for supplementation. While they felt that children in Grades III and IV could be identified by visual examination, those who were in Grade II could not be selected that easily, and according to their perception, it was mainly for the purpose of identifying this group that they were undertaking growth-monitoring.

In this programme, as we have noted earlier, children in Grade II and below alone are intended to receive food supplements, with those in Grade III and IV receiving double the quantity of supplement offered to those in Grade II. However, in actual practice, it was found that *all* children coming to *anganwadis* (irrespective of their growth-status) were fed the supplement. So the only specific use of the growth data in this regard turns out to be the selection of children in Grades II and IV who are entitled to receive a double ration: but, as the workers stated, these children could perhaps have been identified without growth-charts!

The workers did attempt to link weight loss to illness. They reported that they would inform and instruct mothers if a child lost weight, as well as notify the multi purpose worker (or in the urban blocks we visited, the doctor) about the child so that a proper health examination could be conducted. However, it was often found that the health cards maintained by them indicated no information regarding illness etc., which could have enabled proper interpretation of growth data. In the absence of this information, workers had to rely on their memory.

Although the child health card usually had space for the health worker to record 'Reasons for Special Care' or specific 'at risk' indicators, this was invariably left blank. Many of the workers knew which children in their charge

were severely malnourished and usually described their family situation as near-destitute. In many cases the worker felt that there was little she could do about these children, an example of how laboriously collected data go unutilised! Workers were divided on the issue of whether the neediest children were being identified by the growth charting exercise. Workers who had been "in position" for three years or more believed their coverage of under-sixes was adequate to identify all needy children. Those with less service periods were not sure whether the neediest were in the programme and usually blamed mothers for not "caring" and not sending their children to the *anganwadis*. The workers were unanimous in their feeling that no children would come to the centres if the food supplement was withdrawn.

Although in many instances we found that workers gave out oral rehydration salts for children having diarrhoea or iron-folate tablets to mothers, there was frequently a paucity of these items. For example, in the urban blocks we visited in Rajasthan, the medicines were not available at the centres so that even the doctors had to refer mothers and children to the local dispensary. This illustrates how a growth-monitoring scheme which intend to provide primary health inputs will lose much of its value in the absence of adequate vertical and horizontal integration of services. If basic facilities for instituting remedial action revealed by the health card and growth-monitoring are not provided, all the expenditure involved becomes totally infructuous. Unfortunately, where growth-monitoring has been introduced, it has been viewed as only one part of a total system, but often becomes the "centre piece".

Experience in other Asian countries: Similar problems are reported elsewhere. The use of the additional health information collected on the child health card is frequently suboptimal. For example, Solan reports that while information on immunisation is utilised, diet information is not monitored in the Philippines (30). In the UPGK system in Indonesia, the "fourth table" at the weighing posts is intended to provide various prophylactics, but it was found that little attention was paid to this aspect, in part because of the time taken to weigh large numbers of children. For example, Fajans and Sudiman report that only 20 percent of eligible children in one village had received Vitamin A in the previous six months (and fewer mothers (13 percent) reported that their children had actually received them) (37). Generally, the distribution of nutritional prophylactics in this programme was found sporadic due to a shortage of supplies and poor storage facilities at the village level.

Referral is also weak in this programme although it is intended for both at risk' and malnourished cases. Referrals were usually made only of severely

malnourished children or those with acute illness (such as coughs and fevers) but never of children with flat curves or low weight gains. The workers did not recognise the latter criteria as cause for referral. Sometimes, they could not identify severely malnourished children either. Fajans and Sudiman have questioned whether all severely malnourished children are registered in the programme, although those who were registered were weighed as frequently as other children) (37). If health staff were present at the weighing post, no further referral took place, but frequently, the health centres were inadequately equipped to deal with referred cases of malnutrition (even though a nutrition rehabilitation scheme is included in their mandate).

In sum, there would appear to be a general lack of accountability in the matter of referral on the part of primary workers. No well-organised system of referral has been built alongside growth-monitoring operations, with a view to support them and derive full benefit from them. If growth charts are to be used to identify the *sick child* and thus as a basis of primary health care rather than just for food supplementation schemes better procedures and better-managed operations for referral and follow-up are essential.

Most growth-monitoring programmes do not lay adequate emphasis on infection as a possible factor in growth faltering and do not have built-in arrangement for handling it. In TINP, for example, it is only when a child fails to thrive after three months of supplementation that a search for infection is recommended. Cases of growth faltering following on diarrhoea are excluded! It is unfortunate that after a laborious selection process designed to avoid wastage of food supplements, in actual practice food supplements may be wasted because of failure to recognise and treat infections which would cause poor utilisation of food supplements.

All this would imply that where growth-monitoring programmes are being promoted, they have not necessarily been organised as part of a well integrated system of child health care, of which growth-monitoring can only be a small part. Even in the UPGK programme in Indonesia which was conceived of as an integrated programme, the report of Fajans and Sudiman would indicate that the object has not been achieved to a considerable extent. Growth-monitoring is an adjunct or aid to health operations; in actual practice, because of the way growth-monitoring is being promoted and operated, we find that in many situations it becomes the main activity and other health measures are pushed to a peripheral place — a case of “the tail wagging the dog”!

4. Education and Training Aspects

4.1. USE OF GROWTH CHARTS AS AN EDUCATIONAL TOOL

Growth charts are also intended for use in the education of mothers, families and communities about the importance of nutrition for health, growth and development of the child. The growth chart can be used to show mothers how nutrition and preventive health measures affect child growth and development. Ideally, if mothers observe or participate in the process of weighing and regular plotting of the weights, they can be made aware of the importance of weight gain and appreciate the value of weighing. They may then be encouraged to improve their child's weight by following advice given by the health worker.

According to Arole (52) "There is no other simple way to tell a mother about her child's health," and about the role of diet in health. However, to be an effective educational tool the growth chart must be easily understandable to mothers, health workers and medical personnel alike. Unfortunately, as Anandalakshmy and Sindhu (57) have pointed out, the very concepts underlying growth charting are difficult for unschooled persons to understand. They conducted a small field study of the comprehension of growth charts by primary level field workers, mothers, and college graduates, including doctors and other "specialists". They demonstrated that educational level was important for the understanding of growth charts and that prior training was a significant requirement. Field workers who were trained in the use of growth charts and had experience of them fared better than even doctors who were 'familiar' with this tool but had not used it. Illiterate mothers did not understand it. The authors postulate that understanding graphical representation of weight-for-age and linking it up with "reality" requires a high level of abstract reasoning which can only be gained through general education. Certain abstractions which are

intrinsic to the chart are not understood such as the upward or left-to-right path of the weight curve. Even educated women were sometimes misled. "Exposure" was also suggested as important by the observation that urban respondents fared better than rural ones with similar educational status, presumably because of more "sophisticated perception".

On the visits of ICDS centres undertaken for this study, it was found that workers occasionally mentioned nutrition education of mothers as a use for the growth chart. However, when questioned whether they actually used the chart while educating mothers about child growth they usually responded in the negative. They gave several reasons for this. According to them, the majority of mothers were not interested in the weighing of their children, partly because they could not relate weight to their children's health. Alternatively, while some mothers understood the idea of weight gain, they did not understand the plotted weight curve. Most mothers were reportedly conscious of a "weak" or weakening child, but did not relate this to weight, nor could they comprehend how weight estimation could improve their child's health, "educated" mothers were no doubt an exception; but the children of these educated women were perhaps least in need of growth-monitoring!

There are other reports as well that mothers do not understand growth charts, for example, from Nepal (75).

The educational value of the growth chart to the mother is presumed to be enhanced when the chart is retained by the mother herself, rather than left with a health worker or at a centre. While in the ICDS programme to date growth charts are kept as functional records by health workers, there is experience elsewhere of mother-retained health cards. For example, Agarwal reports that in the field practice area of the medical college at Varanasi, in India, cards were kept by mothers initially, and a duplicate maintained at the health clinic by the auxiliary nurse midwives (45). However, mothers frequently lost the cards or did not bring them to the clinics, requiring the ANMs to fill them out on home visits. Anandalakshmy has also reported that mothers cannot maintain child health cards issued by day-care centres (52). Even in Kerala, where the educational level of women is higher relative to other parts of India and even other developing countries, mothers lose and spoil cards and forget to bring them to health centres, and so cards are retained at the centres (85).

Indeed, reports that mothers tear, soil or lose child health cards are ubiquitous and lead to the suggestion that mothers must be educated and

motivated to value the cards as much as a "passport" or a "ration card" (52).

Fortunately, however, we have not come across my instance where a mother is denied a service if she fails to produce her child's card. The value of the card must be conveyed not by a disincentive associated with its loss, but by the incentive that mothers perceive to be associated with its use.

If growth charts are to be kept by mothers, interest in them and awareness of their usefulness must first be created. Cards must be designed not just as records for health workers but so that mothers understand them. A chart designed by the Nutrition Centre of the Philippines, for example, emphasises the educational and motivational objective of the growth chart by printing a number of illustrated nutrition messages on the reverse side (30). There is advice to be followed by the mother to improve the nutritional status of her child or maintain his normal status. Mothers are also advised to bring their children to health centres for regular check up and other health centre-based interventions such as feeding.

However, despite this, Solon reports that a study conducted found that knowledge of the growth chart was confined to workers and the medical staff and that mothers who were interviewed were found to lack appreciation of the purpose of the growth chart and knowledge of its use (30). They had not been taught about it and some did not wish to participate in weighing activities. They did not take the charts home. Instead, they remained for "safekeeping" at the centres.

In six villages of Thailand, two years after the introduction of growth charts for nutritional surveillance, Chittchang *et al* (67) interviewed 292 mothers about the use of the growth charts. They found that 61 percent of mothers could identify the colour of the zone related to normal growth and 28 percent could explain the meaning of different slopes in the weight curve. 32 percent of mothers could correctly identify the nutritional status of their children, 45 percent had read other information contained on the chart but only 23 percent of these could recall the message. Mothers in smaller villages fared better than those in larger ones. (All villages had one field worker). The investigators concluded that the number of target mothers (i.e. village size) and the time available to them significantly affected their level of knowledge and understanding of the growth chart. Other evaluation studies on mothers' use of growth charts are in progress in Thailand (64).

According to Nabarro (74) the growth chart is “not easily understood by mothers in the Indian sub-continent”. He says he is therefore “very cynical about the notion that the “Road-to-Health” card in itself has educational value for the mother”.

On the other hand, mothers may perceive the benefit of parts of the child health card other than the growth chart. Joseph reported that in the Community Health and Development Programme in Tamil Nadu, mothers found the immunisation record and the illustrations useful but did not understand or value the weight chart (52). Patowary also observed that mothers carefully maintain immunisation cards — which are linked to obtaining a specific benefit (52). He has reported that in the urban ICDS block near Guwahati, Assam, 95-97 percent of mothers responded well to receiving the three consecutive doses of DPT immunisations but that the level of interest fell to 62 and below 30 percent for the boosters which were provided much later. Similarly, Srilatha of the Rural Unit for Health and Social Affairs (RUHSA) in Tamil Nadu found, in a small study of 47 mothers in their programme, that 68 percent of mother-retained cards were used by mothers to visit clinics for immunisation and health care, but only five percent used them for weighing. Only 15 percent of mothers were able to explain the use of growth charts and these were literate women. Mothers in the RUHSA programme were reluctant to weigh their children and so did not visit the clinic “just to weigh them”.

It is frequently difficult to sustain the interest of mothers, month after month. Mothers do not see the point of measurement especially if a child appears healthy. Anxiety over a child who is not doing well may motivate mothers to come for weighing regularly. Anandalakshmy has suggested that this connotes a confusion between the preception of the growth chart as an “instrument” and as “treatment” (52).

Community involvement: In certain situations, wider community involvement has enhanced the use of growth charts as an educational tool. For example, the thrust of the Jamkhed programme has been on local involvement in the delivery of child health care of which growth-monitoring is a part (52). When the health project at Jamkhed was started 12 years ago, mothers kept the child health cards. Although initial results were good, with time losses mounted and a different procedure had to be instituted. The responsibility for motivating mothers, collecting children, weighing them and keeping the cards now vests with the Farmers' Clubs. This experience has led Arole to suggest that the educational value of the chart may be enhanced by group (community) pressure

— *i.e.* that peers are able to influence mothers' perceptions and practices better than a health worker's lecture. "Peer teaching" takes place through a process of demonstrating mothers who have coped and those who have not. In addition, community responsibility can be extended to identification and rectification of those social factors that may be causing the child's malnutrition.

As a home-based record, the growth chart may enable mothers to monitor their child's growth themselves. Although the weighing may be done by a health worker, mothers may take an active part in the process and be educated about the significance of the weight curve. Some people suggest that even illiterate mothers can be taught to interpret the shape of the growth curve and "read" educational illustrations on a card. They could be instructed that a flat curve is an early sign of illness requiring intervention. For example Rohde *et al* (49) have described the system in Indonesia where the weight chart was introduced as a tool for mothers' use. Mothers gather at weighing posts, bringing their cards with them. They are filled out by literate women volunteers. Interpretation has been "simplified" into a weight gain — no weight gain demarcation. Peers offer advice to mothers whose children have not gained weight, using "local wisdom". There may be locally organised supplementation of children in need. Children who fail to gain weight any month are attended to by the village Mothers Club and after two months in a row are sent to a health centre for examination.

In the UPGK programme in Indonesia, education of mothers in proper nutrition, child health needs and care is central because the programme is intended to be self-reliant (*i.e.* run by the villages themselves) eventually. However, many problems with this aspect of the programme have surfaced. This programme uses one of the most attractive child health cards we have seen. They are intended to be retained by mothers but there are still cases where cards are kept at the weighing posts (38). Mothers who were questioned by Fajans and Sudiman could not relate weight to their child's health status although most said that a child that gained weight was healthy while one that lost weight was sick (37).

The mothers' lack of knowledge was linked to the poor education actually imparted by health workers during the weighing sessions or on home visits. At the "third table", where weights were entered on cards and in the register, no comments were made to mothers on the weight of their children. At the fourth table, the child health card was not even opened or, if so, it was not used as an educational tool to instruct mothers. In most cases, a few words of advice were given to the mothers whose children were not gaining weight. The messages were usually to feed the child more "healthy" food, more vegetables, etc. Sometimes

a cursory review of how to mix oral rehydration salts was provided. There were no discussions of changes in a child's weight or nutritional status, feeding, giving of ORS, etc. At this "table", prophylactic drugs and food were available and so the main emphasis was directed on distributing them. Education became an empty formality, done in a rush, and was not a true attempt at informing or discussing. The educational posters in the halls were in obscure locations, and not used for teaching purposes.

Independently, Pryosusilo (86) who has worked with weighing programmes in Indonesia for over a decade, has suggested that groups of 20-25 children (and mothers) per weighing post (with a worker at each of the four "tables") would be optimal. The fourth worker could examine the child's card and provide relevant advice and instruction to the mother, which takes time. This ratio and excellent training of the worker, she suggests, would allow effective education to be imparted to mothers.

Fajans and Sudiman (37) found that mothers preserved the cards well in the plastic envelopes provided but regarded them as a record-keeping device for use by the workers (and not by themselves) and did not use or understand the messages on them. Few mothers knew the relationship of the growth curves to nutritional status, nor were they aware of the instructions for mixing ORS or the schedule for immunisations. These latter pieces of information apparently depend on literacy for a mother to understand them. At the weighing posts, because of the large numbers of children to be weighed, there was not adequate time for a worker to teach or advise individual mothers. Providing education would have created an unmanageable bottleneck. "Noise levels" were frequently too high to allow proper communication, and so while educational efforts may have been made with the first few months at the 'fourth table', they broke down as more mothers crowded around. In any case workers frequently *did not know the specific messages* to be given to mothers whose children were not gaining weight. While the demonstration of preparation of local foods served to attract children to the weighing posts it had little educational effect on mothers.

In the UPGK programme, there were also group discussions led by para-medical personnel using flipcharts or other educational aids which the mothers reportedly enjoyed. However, at health centres to which mothers of severely malnourished children were referred, the education of mothers and supervision of their feeding practices was grossly inadequate (38).

Fajans and Sudiman also report the innovation of community-level education sessions and some on workers' home visits. About two-thirds of mothers reported receiving some nutrition education in the latter. (One-third said the worker simply reminded them to attend the weighing session). The investigators regard this as a far more promising approach to education than the centre-based activity.

In fact, other inputs besides the growth chart may be more important in the education of mothers. For example, when workers at Jamkhed were asked what they considered the contribution of the child health card to be to the improvement of child health practices, they valued them at "10 percent", ascribing the remaining 90 percent to other health education methods such as flash cards, songs, skits, etc. (52). Similarly, the growth chart is only one of many educational strategies used in the RUHSA programme which have improved nutritional practices among mothers (52). Another "input" is the personal contact between health workers and mothers that is found in many programmes, particularly those using home-visit techniques, such as the field programme of the Christian Medical College in Ludhiana (Punjab). Mothers become aware of the importance of weight in this way and thus the time spent by workers on home visits may itself constitute an "intervention". Regular contact between mothers and health workers can itself prevent or curtail much child illness and hence, growth failure. This suggests that the value of the growth chart (actually, the child health card) as a "passport" to child health services at a secondary level of care may depend more on the institution of good quality home-based services and less on actual growth-monitoring or education of mothers about the growth curve. If this is the case, a legitimate question can be raised as to whether the "passport" is not a bit too expensive.

Some unanswered questions: All the available data on the use of growth charts as an educational tool, however, leave some important questions unanswered. These may be listed:

(1) Merely 'educating' the mother in the technique of weighing and charting confers no direct benefit to the child unless the mother is also educated as to what precisely she should do in the event of growth faltering. Claims that mothers can intelligently "participate in weighing" do not necessarily mean that they also understand what to do with the child after the weighing is over. In most discussions, there is apparently some confusion between educating a mother as to how to carry out weighing or understand a growth chart and *how to educate her to act* for the benefit of the child on the basis of the growth chart data. It is this latter aspect of education that is woefully lacking not only with respect to

mothers but indeed with respect to health workers themselves. In the UPG project, when the mother “arrives” eventually at the “fourth table”, she may be able to obtain a few words of general advice. Of what real use this has been is not known. The question remains as to whether the simple, least time-consuming operation of “advice” at the “fourth table” could not have been offered in a more leisurely way without the elaborate preliminary growth-monitoring; and whether the mother could have failed to comprehend that advice if she had not watched her child go through the weighing and charting process.

(2) Experience everywhere indicates that any tool is only as good as its user. In the hands of dedicated workers conducting special projects, growth monitoring has been claimed to be a valuable educational tool. But we have no information as to whether these same workers would have been any less successful with regard to education of mothers if they did not have the benefit of the growth chart. As Cowan readily admits, this question cannot be answered with available knowledge (44).

(3) No one has really done a study to find out exactly how much time the health worker spends to successfully educate illiterate mothers on the significance of weighing and growth charts, and whether the same time directly spent on educating the mother in preventive health care — such as how her child’s diet could be improved with the resources available to her; on what would be the best and most nutritious recipes for her infant that she could fashion out of locally available foods; on what she should do with respect to improving her breast-feeding; on what her child’s diet should be during and after diarrhoea, etc. — would not have proved much more rewarding.

(4) There is also no information as to whether less complicated, less time-consuming and less expensive methods of growth-monitoring like, for example, the mid-arm circumference measurement are poorer educational tools than the elaborate weighing and charting technology. Can we not organise a meaningful programme of education based on the data obtained from mid-arm circumference measurement and cannot mothers be more easily educated in its use and in understanding of its significance?

Despite some enthusiastic claims — which may be certainly true in a few exceptional instances — the evidence that growth charts are at present contributing significantly towards education of mothers is not convincing.

4.2. CHOICE OF WORKERS

Growth-monitoring grew out of the under-fives clinic where, traditionally, doctors and nurses or health aids measured and recorded the weights of children who attended (25). Mobile clinics extended outreach by venturing into villages at regular intervals and sometimes included child weighing among their tasks, such as those in the Community Health and Development Programme at Vellore (Tamil Nadu) (53), but still employed doctors and/or nurses to fill out growth charts. More recently, the emphasis has been on sustained village-level growth-monitoring to which questions about workers and training are critical.

The home-visit programme designed by the Christian Medical College, Ludhiana, utilises para-medical workers who are closely supervised by the staff of the medical college. In some areas, such as the field practice area of the Varanasi Medical College, ANMs (auxiliary nurse midwives) make home visits and refer high risk children to clinics for weighing, treatment, immunisation and supplementary feeding. Growth-monitoring is “good” in situations like these where there is a high input of trained manpower — highly qualified staff doing the weighing, and supervision of the overall operation by doctors.

However, in the current health service pattern in India, an Auxiliary Nurse Midwife (ANM) or Multi Purpose Worker (MPW) is required to cover a population of 5,000. In practice, this ratio may be higher, as in Kerala, where according to Philip (85), an ANM “covers” 7,500 people which includes 750-1250 children between zero and six. Philip feels that, given their workloads, it is impossible for these workers to weigh all the children every month in homes and so only those who come to the health centres are weighed. Although this burden may be reduced by selecting a smaller target group of, say, zero to three year olds as in Sanewal block, Punjab, or reducing the frequency of weighing, in practice the task of growth-monitoring is commonly added on to the responsibilities of peripheral health workers because that is how the objective of universal coverage of children (under three or five or six) is considered most achievable. However, these health workers are usually semi- or non-literate, already burdened by numerous jobs (and they are, in most instances, only part-time workers) and so the reliability and utility of their work is often questionable. At RUHSA, literate workers at the sub-centre have been trained to weigh and chart in preference to village-level workers because it is believed that the latter’s main role is education and motivation (52).

If the primary health worker is semi- or non-literate, it may be difficult for

her to "read" the weights and to maintain records. Arole feels that "any adult with common sense can weigh a child," and indeed, at Jamkhed, community members in the women's clubs and farmers' clubs do the weighing and the weighing records are checked every month by the community health volunteer (52). However, Agarwal contends that neither Community Health Workers nor Trained Birth Attendants, who are the primary health workers in the Indian health system, are competent to do growth-monitoring using the currently available chart (52). They have some schooling but lack the education required to plot weights graphically and are unable to fill out cards properly despite extensive training. (The type of care envisioned by the child health card and growth-monitoring are currently not included in the job descriptions of these primary workers at the national level.)

We observed that the *anganwadi* workers in the ICDS programme who had eight to 10 years of education understood and could perform the tasks of weighing and recording well (but with the limitations discussed earlier). However, workers with less basic education appeared to have difficulty with concepts and procedures. In the UPGK programme in Indonesia, the village-level workers are selected in part on the basis of their ability to read and write, but, nevertheless, their performance of the tasks of weighing and recording is frequently poor. For example, in one study, 13 percent of workers made mistakes in filling out the charts. The weighing results were often considered inaccurate (37).

Because of inadequate performance on the part of village-level workers, some alternatives have been suggested. One idea that has been considered is the utilisation of a combination of a primary village-level worker (such as an *anganwadi* worker (in the ICDS scheme) or a community health worker to do the weighing and charting, and trained health personnel (such as Multi-Purpose Workers (in India) to examine growth charts monthly and provide the follow-up. For example, in the UPGK programme, it has been suggested that the village nutrition workers be assisted by the Family Planning Field Worker). In such a system, the para-medical worker could also compile data to be sent to the primary health centre for review by a medical officer. The doctor could then use the material to instruct para-medical workers in the necessary interventions during his visits to the sub-centre. However, the "turn-around time" for this procedure would be much too long even if a smooth working system were in operation. Furthermore, some investigators feel that the person who comes into contact with children and mothers during weighing *must* be involved with other aspects as well in order that growth-monitoring be more than "just a card exercise" (52).

Thus, one of the major issues arising from experience of growth-monitoring concerns the "level" of the worker who monitors growth. The education training and mandate of the worker are crucial, and the size of the population to be served is important. While village level workers may have fewer children to cover, their semi- or non-literate status may result in poor comprehension of the subtleties of growth charting and must be overcome by good initial training and continuous supportive supervision. While they have easier access to mothers and homes, they are farthest away from the supply system for charts, scale maintenance and repair, and for follow up. In addition, the provision of weighing scales, charts and other equipment at the village-level is a costly and logistically difficult operation. On the other hand, more educated and professional workers are available (e.g. Auxiliary Nurse Midwives or other paramedical workers) only at health centres that serve a minimum of 5,000 people, for example, in India. They are relatively inaccessible to populations in distant villages. It may be easier to train them and they require "management" rather than "supervision". When trained paramedics function at centres and provide other services, attendance may be high and frequent. Thus some investigators have concluded that growth charting may be possible in a clinic situation but is difficult on a house-to-house basis (45).

If coverage is to be increased beyond those children presenting at distant clinics, periodic home-visits by these clinic-based workers could be organised. Fewer scales would then be required by these personnel but those would need to be carried from village to village. Maintenance would, however, be centralised and, so, more easily available. Under these circumstances, cards may have to be kept by mothers with all the attendant problems, or replaced by more easily manageable record-keeping systems. Only at a very high level of organisation (such as that described by Cowan) could these workers reach a high proportion of their target group through systematic and regular home-visiting. Cowan points out that the efforts of her medical college staff have been directed primarily at activating the existing governmental health infrastructure, and she considers the Ludhiana system a "time-saving" one and useful for monitoring the entire community (52). More likely, weighing by highly trained personnel will be restricted in time and place, resulting in low coverage. However, these workers have the capacity (training) and facilities available to utilise growth information better than briefly-trained primary-level workers and hence what is lost in quantity may be gained in quality.

Whether at the primary or secondary level, if growth-monitoring is added on to the jobs of already over-burdened workers it is likely to be inaccurate, sporadic and underutilised for health care. To overcome these problems it may

be good strategy to entrust growth-monitoring to workers not burdened with the whole spectrum of health activities. This could well be the merit of the ICDS scheme in India operated not by the Health System but by the Social Welfare Department, wherein the primary responsibility of the workers includes growth-monitoring, nutritional intervention, nutrition education and immunisation. But effective functional linkages between these workers and the health system are essential for management of child illness including referral. As we will see later, even in this arrangement, training of workers and motivation are important and several short-comings are noticeable. After all any system can only be as *good* as the people involved in it. It is the human element rather than the material resources and physical facilities that count, in the ultimate analysis.

4.3. TRAINING OF WORKERS

While educational level may be important for understanding concepts underlying the growth chart, prior training in its use may be a more important variable for proper graphing and interpretation, as Anandalakshmy and Sindhu have suggested (57). Indeed, it is felt that health workers can become proficient in the use and interpretation of growth charts provided they receive adequate training. In the UPGK programme, workers are trained with lecture-demonstration techniques for two to three days. Primary emphasis is placed on weighing and on one day they actually undertake a weighing session in the village. In the ICDS programme, the workers have a three to four month training period covering a large number of topics and tasks. This includes two or three sessions on weight charting.

Clearly those who are trained fare better with growth charts than those who are not, be they village-level workers or doctors. A workshop on the training of *anganwadi* workers, held at the Child-in-Need Institute, Calcutta, identified some of the problems *anganwadi* workers have with weighing and growth charts (48). They found it hard to read the numbers on the weighing scales, to locate the weigh-month junctions on growth charts to plot points, and to interpret the direction of growth despite having been taught this for two hours a day for over 30 days; (In addition, the workers were considered poor at asking mothers their problems before proffering advice but preferred to "issue dogma".)

Although achieving skill in the use of the growth chart was considered important in the training programme, the workshop participants concluded that most *anganwadi* workers in their project area were not proficient at the end of the training period. They consider about five percent of the workers did not have

the capability required, regardless of how intensively they were taught. But they felt that practice was most important for learning. Workers should have "field practice" in the management of weighing at a centre, and the idea of having a trainee team up with a worker who is already functioning well and can demonstrate growth charting in "real conditions" was deemed worthy of consideration.

From the foregoing reports of observations and discussion, it is clear that several aspects of training require attention. Workers need specific and rigorous training in what is to be done. While weighing procedures require stream-lining, these are generally less demanding than recording. Even matters seemingly as simple as filling out the child's "calendar" require attention. Recording of weights is frequently wrong when the worker is new to the task, as we found in the ICDS centres. After several months — perhaps as much as one year — of practical experience and supportive supervision, familiarity with the task and confidence result in considerable improvement. While workers can identify the "grade" of malnutrition in which a child falls, they require special training for early detection of growth retardation, if this objective of growth-monitoring is to be met. Thus, they must be taught to interpret the slope of the curve between weighings. It is also necessary to impress on workers that growth-monitoring is important for nutrition and health interventions, such as control of diarrhoea, measles, etc.; that timely immunisation, for example, could prevent these episodes and forestall a fall in weight. It is necessary to explain that a flat weight curve for several months can indicate a chronic illness like tuberculosis. Without this understanding, growth-monitoring will not lead to other necessary health interventions and may be without effect.

Furthermore, workers who do the weighing need to be taught not only what, but how, to instruct mothers on the relationship between adequate feeding and growth as an indicator of health. If they go into homes they are expected to provide a service, practical advice and demonstration. Board guidelines on education of mothers about the growth chart or infant feeding are insufficient because the growth curve requires translation into effective recommendations for nutritional or health interventions.

Thus, the worker needs practical training in weighing, in recording and interpreting the growth data, and also in diagnosing the underlying causes of any adverse findings, and utilising them for appropriate programmatic follow-up. This also implies that the programme which includes growth-monitoring provides the worker with the means to treat the child or at least to refer the child for timely treatment to another person in the health care system.

It is extremely important that the workers obtain adequate practical knowledge of how locally available inexpensive foods within the economic and physical reach of poor families can be judiciously used to feed infants and children adequately. This aspect of training must be tailored to suit local situations. Many workers confronted by mothers with the question as to what more they should do with regard to improving the diet of their child, have no practical advice and concrete suggestions to offer, vague knowledge at their disposal is inadequate for this purpose. Indeed, training in this one aspect is as much, if not even more important, than training in the mechanics of growth-monitoring. While advice on practical ways of improving the infant's diet will improve the nutrition of the child even in the absence of growth-monitoring, growth-monitoring in the absence of advice will do no good.

Workers must be trained in all these aspects "gradually" — taught a few things at a time and allowed to use and master them. Omnibus training of workers at one point of time results in an overload of information which is easily forgotten when not utilised. Instead, a few special skills, starting with the most important, should be imparted and followed by actual practice. Thus while filling out growth charts requires good initial practical training, continuous supervision and encouragement, and repeated training following "evaluation" are also essential.

Workers should receive feedback on the growth data they collect, to encourage them to improve their performance both in weighing and follow-up. This implies that training in these aspects of the use of growth charts is required *at all levels* of personnel, perhaps starting with physicians, paramedicals and other programme supervisors, who are often "trainers", (such as the Child Development Project Officers who are key — but non-medical — persons in the ICDS scheme) and reaching down to the primary care worker. For example, Cowans reports that in their programme, they have concentrated on training of health workers of all levels (52). Doctors as well as MPWs were trained through a "community grand round" method which involved daily review of the folders of families visited in which there was a pregnant woman or a young child. The child health card, which contains the growth chart and space for information and comments on each home visit, was the primary teaching tool. (Other illustrated training material might also be useful.)

Health workers themselves frequently express the need or desire for better training and orientation in the use of the chart, as was found on the visits to ICDS

centres. They acknowledged particularly, an inadequacy of practical training "on-the-job" and few reported that their weighing and charting work was ever supervised or checked. (In two instances where the workers were too diffident to plot weight data themselves, they reported that the supervisors helped them to do so.) But generally, weight charts were only checked by supervisors to ensure that workers were weighing children and data were examined to establish numbers of children qualifying for the feeding programme.

From experience gained at the Comprehensive Rural Health Project at Jamkhed, Arole observes that a worker's performance in growth charting may have more to do with whether they are motivated and interested in the job of weighing than with their educational level *per se* (52). He states that workers require detailed explanation on filling up cards, etc., taking five to six hours of teaching, but that motivation is extremely important. Their performance is poor also if weighing is the only activity. They do better if involved in other aspects of health care delivery and with the family. Indeed, workers who have used growth charts appear reluctant to give them up, according to Cowan (52). In the ICDS centres visited also, it was found that workers viewed weighing not as a chore but as central to their work, and wished it to continue. They tended to explain poor results by the lack of response from mothers, and frequently expressed frustration on this score. On the other hand, there are several reports that dedicated workers engender high compliance or attendance rates among mothers (37, 52). The amount of time that workers in the ICDS programme spend in homes is perhaps not enough to motivate mothers to the extent necessary.

Thus, selection of highly motivated persons, good training and continuous supportive supervision would appear to be among the prime requirements of reliable growth-monitoring. Careful consideration of the wide range of expertise expected of the primary health worker, given her own educational background, the varied jobs she is expected to accomplish, and the time-frame in which this has to be done indicates the intensity of training and supportive supervision that is needed. Even if training of a high order is imparted, the question whether the worker can accomplish all the required tasks still arises. In this context, is it wise strategy to burden her with the task of carrying weighing scales to individual homes, of charting growth data on "Road-to-Health" cards? Can this be done without detriment to the other duties of primary health care?

Some issues in training: The training aspect must also be examined in the context of the *total training* of the health worker not only in growth-monitoring skills but in other skills relevant to her work. Here it becomes important to

determine to what extent training in weighing and growth charts encroaches on other essential aspects of the training of the health worker. Is the time that has to be spent on this aspect of training commensurate to the relevance and essentially to the operation — in relation to those of other operations?

Is it possible to conceive of different levels of training in growth-monitoring for workers with different levels of educational background? Would it be desirable, for example, to opt for training in simpler methods of growth-monitoring such as mid-arm circumference measurement for the basic level health worker and reserve training in more sophisticated technologies for workers at the higher echelons of the health system at the clinic/centre levels or those engaged in special programmes like ICDS?

How adequate is the training in age verification? Has this aspect of training to be tailored to suit special needs?

Is it not necessary to introduce procedures for obtaining feed-back on the efficacy of "training" in growth-monitoring from investigation of the accuracy of the recordings, age verification and plotting growth data in the field? The reported observation that quite a large proportion of "completed growth charts" in many growth-monitoring operations do not fulfill the requirements of accuracy would lead to the conclusion that even the training with respect to weight reading and recording (let alone interpretation and follow-up action) is not adequate. It is also necessary to evaluate if training of health workers with low educational status in simpler techniques of growth-monitoring leads to far less errors in the recording than training in more complicated technology; and that, as a result, with more accurate data using a less sensitive technology we may perhaps be actually better off.

It will be seen from the foregoing discussion that there are four different levels (aspects) of training for growth-monitoring using growth charts: (1) weighing and reading scales; (2) recording weight reading in the appropriate point on the growth chart after age verification; (3) interpretation of the chart; and (4) follow-up action. These four levels call for different orders of competence on the part of both trainees and trainers. The first is the one that perhaps can be accomplished most easily with health workers of low educational levels, with trainers of average ability and in a short time. The second may be possible with health workers who have at least completed the secondary school level education. The third will certainly be well beyond the competence of most village level health workers in developing countries and, perhaps, sometimes

even of some medical graduates. The significance of actual weight in relation to standard; of the slope of the curve; of catch-up growth; of the order of weight gain; of the significance of other information on the growth card (diarrhoea, infections, etc.) on the interpretation of growth data — will be difficult for the health worker to comprehend. It is no wonder then that all that most of them now do with the growth chart is to identify the colour zone into which the latest weight measurement falls. The most practical and most important aspect of the training — indeed the aspect which invests the entire growth-monitoring operation with relevance and practical utility — is the last aspect (No. 4 above); and this is precisely the aspect that is now the weakest. This is the one aspect which will enable the worker to educate the mother on correct child feeding practices — the aspect which is ultimately directly connected with the promotion of child health/nutrition. It may be argued that if the health worker was not overburdened with training on the three earlier aspects (which are only preparatory to the last one) it may be possible to equip her better for the central task of education and counselling of mothers. The latter carried out without growth-monitoring will still help the child; but even the most elaborate growth-monitoring, without education and counselling of the mother will do no good. The training programme must reflect these priorities.

The varied levels of competence of trainers and trainees called for in successful training of the four different aspects, coupled with our current expectation that a single village level worker, given her present level of education should acquire proficiency in *all* of them explains some of the current deficiencies in the use of growth charts by village-level workers.

The importance of infection as a factor in growth faltering: Interpretation of growth faltering, and decisions regarding appropriate follow-up action call for adequate comprehension of the synergistic interaction between infection and dietary deficiency — the twin factors invariably coexisting in poor communities. The relative contribution of these two factors may vary between communities, and between individuals within a community. The worker must be trained to decide on the basis of the dietary history and history of infection, as to which of these is the dominant factor in a given case. The educational level of the worker and her training, most certainly do not equip her to exercise this judgement. Thus, a very important benefit of growth-monitoring, namely early detection of incipient infection, is hardly realised in practice.

5. Evaluation of the Use of Growth Charts

5.1. THE INDIAN EXPERIENCE

There have been few attempts to evaluate growth monitoring *per se* or to determine its effectiveness. Evaluation of growth charts also is made difficult because the child health card which includes the growth chart also contains other important information bearing on child health. It would be difficult to decide, under the circumstances, if any observed benefits are due to the growth chart *per se* or to the availability and use of the other information on the health card.

The RUHSA experience: At the Rural Unit for Health and Social Affairs (RUHSA) in Tamil Nadu, growth-monitoring has been done as part of an integrated health and development programme for a population of 100,000. Over 11,000 child health cards are available and Srilatha has analysed their content in an effort to evaluate the use of growth charts (87). She has also carried out a small study on mothers' perceptions of weight charts.

In this programme, all children under two have family-retained health cards and duplicates are kept at the sub-health centre. A health aid at the sub-centre weighs, records and interprets the information and gives nutrition advice to mothers, and also instructs village health workers about follow-up. The village workers motivate mothers on home visits to attend the clinic regularly for weighing. The growth charts are used primarily to identify children requiring supplementation. Children with second and third degree malnutrition are given food supplements free every week for six to 12 months and are expected to be weighed at the subcentre monthly until normal weight is reached.

The analysis of 11,382 cards showed that during the first two years of life, 53 percent of children attended the clinic less than five times, 34 percent between five and 10 times, and 10 percent more than 10 times. Only 51 percent had been weighed at least twice during the first two years. Srilatha has concluded that monthly weighing is *not* feasible because the frequency of visits to the clinic is inadequate (52). On the other hand, she also feels that weighing in homes would take too much time and detract from education which is the main task of peripheral health workers. The growth charts were *not* useful to monitor the nutritional status of the community as a whole because of a high drop-out rate. Srilatha feels that growth-monitoring is *not* practicable or relevant to community-based efforts. She argues that improvement in community nutritional status can be brought about without weighing all children every month. As the programme's main emphasis is on nutrition education, growth charts are considered not to have "first priority". Expectant mothers, poor mothers, those with children under two or malnourished children are given a one-month course at the village level. (They receive compensation for daily wages that may be lost due to participation in the programme.)

However, the RUHSA programme has registered some impressive achievements. It has reduced the percentage of severely malnourished children (shown by a survey using mid-arm circumference) and has shown a lower prevalence of "wasted" children compared with a control block. Srilatha ascribes this to the integrated approach and *emphasis on nutrition education* which has changed mothers' breast-feeding and weaning practices. Several educational strategies such as films, puppets, role plays, cooking demonstrations and discussions are used in the nutrition education programme besides growth charts. Group education techniques are considered more effective than individual-oriented ones. Similarly, a community-oriented nutrition monitoring system may be more useful than growth charts which focus on individuals.

The Gujarat experience: Patel and Gopaldas (82) undertook a small study of *anganwadi* workers in Baroda (Gujarat). As we have pointed out earlier, the *anganwadis* and *anganwadi* workers investigated were a specially selected group. (For example, one centre out of seven selected initially was discarded because there was no proper facility to hang the scale. The worker held the scale in her hands while weighing.) Therefore, these observations can only be used to infer what could be achieved if adequate facilities and a high degree of training and motivation were available. (In actual practice these conditions are only fulfilled in a small proportion of "centres" in any large-scale field programme.) First, they checked the weights of children plotted on charts by the workers, against weights obtained by themselves. They found a high degree of agreement between measurements (97 percent) and concluded that *anganwadi* workers

were able to take accurate weight readings. They also found 100 percent accuracy in plotting of weights on the charts. However, even in this selected group investigation, growth charts were "available" for only 77 of the 90 children weighed (86 percent). For the remainder, "plotting" was done on a spare growth chart and the child's "grade" obtained. Second, these investigators studied the workers' interpretation of the growth data. They found that the workers were able to identify "grades" of nutritional status and decrease in weight as a sign of growth retardation. However, neither the workers nor supervisors "interpreted" flat or decelerating curves correctly. *35 percent of children who had no weight gain for three months or more thus remained without any intervention.* Third, the follow-up provided by workers are investigated. Workers apparently informed mothers about changes in their child's weight at the monthly weighings, but *only* mothers of children in Grades III and IV received feeding advice and a food supplement. Other mothers received advice on hygiene while the mothers of all infants were advised to complete their child's immunisations.

These examples illustrate how information from growth charts is used primarily to select *beneficiaries* for supplementary nutrition. The selection is usually done on the basis of the child's "grade of undernutrition". Children in more severe grades may be selected for feeding while those who are mildly or moderately malnourished may be given only advice. But, as we have seen earlier, "advice" and "nutrition education" apparently occupy a "back seat" with the result that the net effect of the programme is concentration on the severely malnourished to the neglect of the less severely undernourished.

The World Bank-assisted Tamil Nadu Integrated Nutrition Project: In this project, the 'on-weight gain' criterion discussed earlier has been employed for the selection of beneficiaries for supplementary feeding programmes. The project also employs 'exit criterion'—a child that has gained 500 gm. over three months of feeding is considered fit enough to graduate out of the programme.

A mid-term evaluation of this project conducted in 1982 after 21 months of programme operation (83) found no overall improvement in nutritional status of the children. When all grades (I to IV) of under-nutrition were considered, there was no improvement in children of either the seven to 36 months age group or of the 37-60 months age group. When Grades III and IV undernutrition alone were considered, again there was no evidence of improvement with respect to the seven to 36 month age group. The only improvement noted was with respect to the prevalence of Grades III and IV undernutrition in children of the 37-60 month age group. The high 'graduation' rates among children participating in the feeding programme (10 percent per month and even 20 percent during

certain months) was not reflected in significant overall improvement of the nutritional status when all children were considered. In this project, since growth-monitoring started after six months of infancy, mothers of infants less than six months old received no special attention; it is possible that many of the children who showed undernutrition between seven and 12 months or even between 12-24 months were those in whom undernutrition had already set in, by six months; the application of no weight gain criterion for nutrition intervention in such cases cannot be expected to improve nutritional status. Apparently, the main concern in the project was to limit supplementary feeding to the absolutely needy—needy beyond the slightest doubt.

However, a subsequent evaluation report on the project in 1984 (HO T.J. June 1984) provides a contrary picture and claims very favourable results. Children are reported to have moved up in the nutrition grade, with reduction of children in Grades II, III and IV malnutrition and increase of those in normal and Grade I. The “disappointing” result, however, according to this report was “the fact that while the project seems to be doing very well for children aged 13-60 months, it has not improved the nutritional status of children aged six to 12 months”. The Report concludes that “overall the review findings on nutritional impact of the project are very favourable”.

The relapse rate (that is the percentage of children who had ‘graduated’ out of the programme but who had to re-enter it because of recurrence of growth faltering) was roughly around 25 percent, according to data furnished in a report by Nirmala Murthy on the project (Suggestion for Simplifying Monitoring System: 1982). The relapse rate had no relation to the duration of feeding. This raises the possibility that in many of these children, apart from dietary deficiency, continued infection was the important causative factor involved in growth faltering. Food supplements in such cases can at best have only a temporary effect. This again underscores the need for building in arrangements for detection and treatment of infections in growth-monitoring operations in order to derive the full benefits. Without such arrangements, even the most rigid selection processes as the one employed in this project will result in poor utilisation of food supplements in a considerable proportion of children.

A scrutiny of the evaluation reports on the project (including the optimistic one of 1984) raises serious doubts about the validity (let alone superiority) of the ‘on-weight gain’ selection strategy. Thus, according to the 1982 report (85), the total number of children in the pilot project area in the period October 1980 to July 1982 fluctuated between 2500 to 3400. The number of cases of Grade III malnutrition declined from 16.80 percent of the total to 14.6 percent (which

could be considered to be in line with the claim of reduction in Grade III malnutrition from 17 percent to 11 percent in the evaluation report of 1984). However, the number of beneficiaries, other than those in Grade III, identified each month as being eligible on the basis of the low-weight-gain criterion, progressively increased from month to month between October 1980, when the project started, and July 1982 (83). Allowing for the possibility that the identification procedure attained full momentum only a few months after initiation of the project, and, therefore, assuming July 1981 as the base, we still find a progressive increase in the number of new beneficiaries identified in succeeding months between July 1981 and July 1982 while the total number of children remained more or less stationary. It is difficult to reconcile this finding of increasing number of new candidates eligible for feeding in successive months, with the claim of overall improvement of nutritional status.

Secondly, it is noted that while the overall number of children above Grade III who require supplementary feeding was roughly over 30 percent of the total number of children (83), the number of children in Grade II malnutrition according to the 1984 evaluation report was also 33 percent. This would imply that practically all the children of Grade II malnutrition were candidates for supplementary feeding on the on-weight gain basis (unless there was a drastic reversal of trends between 1982 and 1984. The claim that children "moved up in the grade of nutrition" has to be judged in the light of this finding. These findings are perhaps to be expected considering that in this project a weight gain of an order which can only help a child to continue its status quo in Grade II was considered acceptable and children had to 'demonstrate' their low gain status for some months before they 'qualified'.

If the total number of children in Grade II malnutrition is thus almost similar to the total number of children outside Grade III found eligible for feeding by the low-weight gain criterion, it cannot be claimed that this latter strategy offers any advantage over the ICDS strategy of considering all children in Grades II and III as being at risk.

5.2. GLOBAL EXPERIENCE

The UPGK Project: The criterion of no-weight-gain-for-three-consecutive-months is also used to refer children in the UPGK programme to health centres and presents similar problems in those circumstances, as Fajans and Sudiman have reported (37). Thus, in spite of instructions to the contrary, some children who are in a low grade of nutrition and continue to move downward are not

identified as needing special intervention just because they have gained some weight and so do not come under the 'no-weight gain' category, which alone will entitle them for attention. Secondly, the programme stipulates that the three months of no weight gain must be consecutive. Thus, if a child is absent any month, his weight the following month cannot be compared with the earlier months. According to this system, a child may never gain weight but if he is absent once in four months, he may never be selected by the no-weight-gain criterion. The investigators concluded that at current levels of attendance it is highly likely that one half to two-thirds of children who are at risk will not be identified by this criterion.

Data collected by Fajans and Sudiman (37) on malnutrition among children in the programme villages studied by them show that programme activities are either not always successful in identifying children at risk (deteriorating nutritional status) or not able to prevent further deterioration if children are identified. They also found no relationship between the length of children's participation and the percentage achieving the desired weight at age three. Furthermore, Fajans and Sudiman report that accurate population data are frequently not available, making the programme coverage statistics unreliable. Registration data were not updated by removing children who had left the village and so figures were sometime inflated. They noted many discrepancies between data on growth charts and those in the registers used to compile the monthly reports. The programme effectiveness indicator was subject to wrong interpretation by the workers and dependent on attendance, so that one is unable to distinguish poor programme performance due to low attendance from that due to inadequate weight gain.

It must be added that the inputs in resources and manpower in the World Bank-assisted Tamil Nadu Integrated Nutrition Project and the Indonesian UPGK programme are indeed very high. These programmes are not part of the activities of the 'regular' health system of these countries, but are in the nature of special projects. Thus, evaluation reports are important in consideration of programme improvement and expansion. These provide important lessons on the use of growth-monitoring data.

The Mexican experience: From Mexico, the country whose scientists pioneered the use of growth data for quantification and "gradation of undernutrition", Chavez (88) observes: "Most of the health personnel just fill the chart with data, without interpreting them, and worse, without using them to prescribe dietary counselling".

The African experience: Bailey (54), who has long experience of the nutrition scene in Africa observes: "The recording of weights for age is often very badly done. In some university undergraduates, supposedly trained and experienced in this job, I have found up to 80 percent of errors in plotting weight for age, even with the supposedly simple system of boxes along the bottom of the chart....Clinics seldom analyse the data which are at their disposal. It is this organisation of a system of nutritional surveillance through MCH clinics (especially for analysing and reporting aspects) which is sadly lacking."

Nepal: Nabarro (74) who has pioneered some innovative studies on growth in Nepal concludes: "My own experience suggests that regular weighing and charting on "Road-to-Health" cards is not necessarily the most appropriate means of identifying children who need special interventions in situations (a) where one worker is primarily responsible for providing intervention and is, therefore, in constant touch with, say, 75 children and (b) where the infrastructure for providing care is still poorly developed."

Philippines: Solon (30) concludes a comprehensive review of the Philippines experience in the use of growth charts with this query: "Essentially, we are faced with two basic questions whether or not our growth chart should be made or intended for home-based monitoring, and more importantly, whether we are prepared to undertake this type of monitoring at this point in time, considering organisational, manpower and logistic requirements".

Middle-Eastern countries: With respect to Middle Eastern countries, K.S. Rao (89), who has had considerable experience of nutrition programmes, states: "Most of the Health Administrators in the Middle-East make growth charts available for use in their health-service networks. However, with some exceptions, perhaps, the use to which these cards are put is widely variable even within the same country. In the smaller health units or centres where staff is somewhat limited, no use is made of the charts. In some other centres, weight is recorded almost as a ritual, but rarely plotted on the chart, and it seems rather doubtful if this information is put to any further use. I am afraid that those taking weights are unaware of its purpose....Among the constraints in the use of the charts, I believe that the most important is lack of appreciation on the part of concerned health staff of the potentialities of child growth information, not only as a diagnostic and monitoring tool on individual basis, but also as a reliable national health indicator. This is not confined to those who actually take the measurement but also to the supervisory staff, who are actually expected to utilise the information. Thus, it is a question of education and training, more in

practical terms, extending to all the health-service tiers."

Many of the shortcomings observed in currently ongoing growth-monitoring operations in developing countries stem from the fact that workers have generally failed to appreciate that the growth chart is just a diagnostic tool which cannot *by itself* make any difference whatsoever to the health/nutrition of the child; that it is only a tool to facilitate positive action.

The general conclusion that emerges is that at present, the "success stories" and the highly optimistic reports of the utility and efficacy of growth-monitoring programmes are restricted to small-scale operations carried out under dedicated leadership, with managerial expertise of a high order, competent supervision and high inputs. In large-scale programmes of the type which are likely to be attempted in public health systems of developing countries, the results have apparently not been encouraging as the infrastructure into which this growth-monitoring technology has been introduced appears to have far too many shortcomings.

6. Growth-Monitoring in Primary Health Care in Developing Countries

6.1. THE RELEVANCE OF GROWTH-MONITORING

In most discussions on the use of growth charts, it is the technicalities of the growth charting process that claim central attention. The subject of growth-monitoring is rarely considered in the total context of primary health care in developing countries.

The health systems of developing countries are now subject to tremendous pressures and have to contend with a very wide spectrum of significant health problems—communicable diseases like malaria, tuberculosis, leprosy and diarrhoeal diseases; poor sanitation; lack of safe water supply; and more than all, the widespread background of undernutrition. These problems are being continually and progressively aggravated by deepening poverty, relentless population growth, and consequent increasing inadequacies of food supply. While the challenges which the health systems of poor developing countries now face are formidable, the resources available to the health sector are woefully inadequate, in the context of the competing claims of other sectors (food and agriculture, energy and water-resources management, transport, housing, industrial development for employment generation etc.) considered more crucial for “development”. As a result, the prevailing health infrastructure in most developing countries suffers from serious inadequacies with respect to material resources, trained manpower, and outreach to rural communities. Any proposal to introduce new health technology in these countries must take into account the health systems in their present state of development, and consider only those additional inputs that are realistic and feasible. The introduction of

any new technology, which requires substantial additional financial and manpower resources for its meaningful implementation, will pose grave problems. If such a technology is used merely to provide “diagnosis” of the situation, rather than directly contributing to its prevention or mitigation, it will attract no support.

Costs: As we have seen in the foregoing chapters, reliable and meaningful growth-monitoring using the weighing technique and growth charts, requires considerable inputs. Even a single item, such as the regular, adequate supply of reliable weighing scales to villages and their periodic servicing and replacement, calls for substantial investment. If models like the one employed in the UPGK project in Indonesia are introduced a very substantial augmentation of trained manpower will become necessary. (No programme can be permanently sustained by volunteers.) The operation also calls for managerial and organisational expertise of a high order, which not all developing countries can easily provide. More than all, if the entire operation is not to degenerate into a weighing ritual (which is unfortunately the case at present, in many situations), follow-up action to remedy the problem revealed by growth-monitoring must be an integral and essential component of the operation. This implies that the countries concerned must have the resources and facilities for such follow-up action as well.

The colossal cost of growth-monitoring programmes which involve *individual surveillance* of the under-fives in a country using monthly weighings and growth charting has apparently not been fully appreciated. There are claims that 50 percent to 80 percent of under-fives are now being covered in such countries as Lesotho and Botswana. It is difficult to estimate the cost of such growth-monitoring programmes with precision. For instance, it is difficult to ‘cost’ the services of so-called women “volunteers” used in Indonesia for the operation, or the wages lost by working women waiting for hours in long queues at weighing *melas* (several hours sometimes) to get their children weighed and ‘less-than-two-minutes’ cursory advice thereafter. Subject to these limitations, we may briefly examine the implications of 50 percent coverage of under-fives in India:

Approximate number of under-fives to be covered on the basis of 50 percent coverage.	55 million
Approximate time taken for 12 monthly weighings, plotting the weight after age verification, charting on the graph and interpretation—for <i>each child</i> at an average rate of 10 minutes per child for each weighing session.	2 hours (10 minutes × 12)

Approximate number of children that can be covered on the basis of a four hour working day and 250 working days in the year by one health worker.	500
Approximate number of health workers needed to carry out growth-monitoring <i>only</i> and no other health service for 55 million children.	110,000
Approximate computation of cost involved for "stipends" of 11,000 workers at the ridiculously low rate of \$250.	\$27.5 million

The above calculation does *not* include the cost of scales (many of which are imported), their maintenance, repairs and replacements, the cost of adequate supply and replacement of growth charts, transport etc. If one Salter scale were to be provided for a population containing 100 under-fives, it may be estimated that the cost of initial purchase of the required number of scales will be roughly \$20 million! This expense has to be incurred periodically every five years and the cost of maintenance, repair and transport must also be included. To this must be added the cost of 'training', 'supervision', regular supply of growth charts, etc.

A study in Indonesia estimates that the cost of growth-monitoring per child covered per year works out to \$6.50 per child, but this apparently does not include the cost of scales and material inputs, and the workers "volunteer" labour (38) when calculated per caput, this cost was equivalent to a significant proportion (88 percent) of the annual per capita budget of the Ministry of Health. The programme's initial "out-of-pocket" expenditures are essentially covered by a major grant from a bilateral assistance agency, but obviously this cannot be a permanent arrangement.

Logistics: There is also no evidence as yet from available reports that the weighing and growth charting operations being promoted at great cost in some countries have in fact resulted in improvements in the health and nutritional status of the children being weighed. The enthusiastic claims in this regard do not seem to be supported by hard evidence. On the other hand, there is evidence that in some situations, the excessive preoccupation with the mechanics of weighing and growth charting and the anxiety to achieve 'wide coverage' in this regard leave little time for health personnel to fulfill other duties, such as education of mothers which may pay greater dividends in terms of improved child care. All this, however, is not to deny that in small-scale projects under dedicated leadership excellent results have been achieved. But these appear to be the exceptions to the general rule.

While many health scientists have enthusiastically promoted weighing and use of growth charts, others who have also had considerable experience of the “realities” of health systems in developing countries have sounded notes of caution. Thus Solon (30) speaking of home-based growth-monitoring using weighing scales and growth charts, has raised the question as to “whether we are prepared to undertake this type of monitoring at this point in time, considering organisational, manpower and logistic requirements.” Vijay Kumar (46), again referring to weighings and growth charts, cautions that the technology “should be applied only to the extent that the community and the health infrastructure can absorb”. Nabarro (74) is even more forthright when he says: “Many of the leading practitioners of primary child care are enthusiastic about the value of growth charting as a means for providing a longitudinal record of children’s progress. Child weighing is therefore seen as a central activity—a *sine qua non* for child health care programmes. Anyone who questions this dogma is sometimes thought to be committing a heresy. Yet my own experience suggests that regular weighing and charting on “Road-to-Health” cards is not necessarily the most appropriate means for identifying children who need special intervention...”

An argument sometimes advanced (privately) in favour of weighing and use of growth charts by health workers at the home level, is that this will at least ensure regularity of contacts between health workers and mothers, because the serial weight recordings can be checked by a supervisor. But the same purpose will be served, at much less expense, by the scrutiny of health cards (without growth charts) which provide for monthly recordings (in cms.) or arm circumference measurements.

Cowan (44) argues that while we may perhaps do away with home-based weighing (and rely on arm circumference measures) *after* the child has crossed infancy, monthly weighings would be very necessary during infancy. She finds that, at present, inappropriate advice by health personnel (e.g. offer boiled water between breast-feeds; give glucose water between feeds; start supplements by the fourth month) is directly responsible for diminution of breast milk supply in poor underprivileged mothers; this leads to flattening of the growth curve, which if detected early through periodic weighing (it cannot be detected by the eye) will alert the health worker and she could then counter it by what Cowan calls the “increase breast milk supply” technique. Cowan herself has applied this technique with remarkable success in her own project area. The ‘increase supply’ technique which Cowan refers to involves the following advice to the mother: “Start feeding the infant after one hour of birth; give the colostrum; recognise that the first 48 hours are learning hours and the baby has enough store to keep him going; feed every one and a half to two hours if he

wants it; learn how to 'latch' him on the breast; if he seems unsatisfied, drink more fluids, eat more of your daily diet, rest and relax and feed oftener; if you think location is failing, work hard at re-establishing it ..." Cowan feels (and has demonstrated) that with this technique, supplementary feeding is wholly unnecessary for the first six months, and the child is well-nourished by the end of the first year. While we endorse Cowan's approach towards promoting breast-feeding, it is still not clear as to why a health worker has to wait for the growth curve to flatten and "alert" her, before she starts giving the advice involved in the "increase breast milk supply" technique. Cannot the health workers be trained to impart this advice to all nursing mothers without having to await the results of growth charting? Workers can much more easily be trained to impart the advice suggested by Cowan than to use growth charts. Since breast milk is the sheet anchor of infant nutrition, at least as far as the poor are concerned, it will be best to beam this advice to *all* nursing mothers, even if this sometimes involves erring on the safe side.

Srilatha (52) has argued that weighing and growth charting are unnecessary in preventive and promotive child health and nutrition programmes directed to communities, at the primary health care level. She suggests that these are appropriate clinic-based operations, but must not be added on as an essential part of the duties of the village-level health worker because they detract from motivational and educational work which is of primary importance.

Concept: Indeed the very concept of measuring the severity of undernutrition through growth-monitoring before undertaking preventive and promotive health and nutrition programme among obviously poor and deprived communities can be questioned. An overwhelming majority of children in poor communities in developing countries are currently undernourished, and are in various stages of growth retardation. Among poor communities, it is frequently the case that only less than 10 percent of under-fives exhibit truly 'normal' growth. If we accept the position that all children who are undernourished need attention, it may not be important for the purpose of a promotive and preventive *community* health and nutrition programme to measure the severity of undernutrition in each individual child with mathematical precision. The sensible strategy will be to beam programmes of prevention to the community as a whole, when we know that the problem is widespread. This is precisely what is done with problems such as anaemia and vitamin A deficiency. In these cases, laborious determinations of haemoglobin concentration or vitamin A status of individual children are not undertaken to target action only on the "severe" cases. Growth-monitoring, as a device for identifying the severity of energy-protein undernutrition, is in fact much less precise, sensitive and specific than haemoglobin estimation.

An argument sometimes advanced is that because developing countries have scarce resources, there must be a selection process which would help to identify those in special need so that the scarce resources may be targeted to them. This argument would be valid if the cost of the "identification process" were only a small fraction of the cost of the proposed intervention. The only feasible intervention in most cases is nutrition education and advice to mothers, and this intervention is perhaps best done taking advantage of group or peer pressure. Thus the cost of the intervention is far less than that of 'identification' through weighing and growth charts.

The relatively expensive intervention of supplementary feeding can be resorted to only for a small proportion of the population, but even with regard to this, the strategy of a preliminary identification process may be questioned. In fact, the main purpose to which growth-monitoring operations, involving weighing and growth charting, are currently being put in some projects is the identification of 'beneficiaries' for supplementary feeding programmes. The supplements are usually foods donated through bilateral or international agreements. It is argued that food is expensive and, therefore, the neediest (that is, the most severely undernourished) children must be identified and growth-monitoring is chosen for this purpose. However, the manpower, institutional resources and money which poor developing countries expend in undertaking the "beneficiaries-selection process" far exceed the cost of the "food gift". This poor strategy can be likened to "stitching a suit around a 'gift button'". The virtual immobilisation and diversion of scarce resources available for health programmes of developing countries implicit in this wasteful strategy, is unfortunate and inexcusable. In the ICDS programme in India, where also growth-monitoring is used for selection of candidates for feeding, it has been found from experience that the "selection" process breaks down when confronted with hard realities. *All* poor children presenting at the ICDS centres receive supplements, irrespective of whether they have reached the qualifying grades of growth-retardation or not (with the difference that those with 'severe' undernutrition get double ration). Apart from doubts about the scientific validity of selection based on arbitrary cut-off points, the "selection strategy" denotes a lack of understanding of the psychology and sensibilities of poor communities, subject to serious socio-economic deprivation. The harm that arbitrary 'exclusions' and 'selections' of beneficiaries based on arm-chair hypotheses, could inflict within such communities appears to be ignored by the 'operators' of these programmes.

We recommend that expensive weighing and growth charting operations

should *not* be undertaken just for the purpose of identification of beneficiaries for a feeding programme. Where food supplements are available for distribution to the needy, the right strategy would be to identify the poorest and most deprived *communities* (like the harijan hamlets, tribal settlements and urban slums in India) and target the feeding operations to *all* children in such communities (the overwhelming majority of whom will be undernourished). In other words, the proper strategy is to identify and *select communities* at risk and *not individuals* at risk in the general population; and such identification of communities does *not* need growth-monitoring.

Nabarro (74) says: "In countries or regions with limited resources for child care, a target *group* has to be chosen for the intervention In practice, programme administrators will need to focus on identifiable social groups who face a high risk of nutritional problems and offer a standard intervention to *all* their members" This view is entirely in consonance with the views we have expressed in the preceding paragraph.

6.2. THE MERITS OF GROWTH-MONITORING

The case for growth-monitoring (and here we refer to growth-monitoring in general and not necessarily the weighing and growth charting operations) rests on other grounds. The real merit of growth-monitoring lies in that it could provide valuable "direction" and support to the health worker in her efforts to improve child health; in her interactions with mothers and the community; in her efforts at "nutrition education" to improve a child's diet and nutrition status; in assessing, for her own satisfaction, the impact of her efforts on the child's nutritional status, and in demonstrating the impact to the mother. Thus, growth measurement data could act as a valuable ally of the health worker. However, for growth-monitoring to be used as such a tool for *prevention of undernutrition*, the emphasis must be on *detection of early growth faltering* (rather than on "repair and relief" of the severely malnourished alone). Growth-monitoring could also serve a wider purpose; if the growth data are periodically collated, they could provide valuable statistics of changing trends in child health and nutrition in the community and the country. However, we must emphasise that the improvement of child health and nutrition must be seen as the main objective of growth-monitoring with data collection playing a much more minor role. Otherwise, as we have seen, more attention is paid by workers to filing reports than to the pressing tasks of child health.

Growth-monitoring could help to provide a better focus for "nutrition" in

the primary health care package. At present, although undernutrition is a major problem in most developing countries, the “nutrition component” of Primary Health Care systems is extremely weak. Emphasis is placed on “cure of ailments”, immunisation, family planning and, more recently, oral rehydration. ‘Nutrition’ generally takes a back seat, though lip-service is often paid to “nutrition education”. The reason for this is not far to seek. Cure of ailments, immunisation, family planning and oral rehydration are straight “well-charted” operations, relatively less time-consuming, and lend themselves to easy “achievement audit”. Nutrition care which involves changing dietary mores and prejudices calls for far greater innovative skill and communication expertise than some other health operations. It is, for instance, much easier to jab a needle (for immunisation) into a child after temporarily coaxing and “silencing” the mother, than to get her to change the feeding pattern of her infant. Unfortunately, at present the health worker has no way of demonstrating to the mother that her child is undernourished and of showing her how, as a result of *changing* (improved) feeding practices, the child is improving. Growth-monitoring could fill this gap and convert what at present is a nebulous and vague operation into a purposeful effort which would lend itself to “achievement” and its “audit”. Nutrition then may not continue to occupy the back seat in the primary health care package.

But all the merits of growth-monitoring will be defeated if the technology chosen for it places such heavy demands on the “system” as to hamper its use and effectiveness. In short, while we fully recognise the value of growth-monitoring we must be very careful in our choice of growth-monitoring technology.

6.3. APPROPRIATE MODELS OF GROWTH-MONITORING FOR DEVELOPING COUNTRIES

Much of the experience world-wide indicates that growth-monitoring as is currently being carried out in many developing countries (using the weighing technique and growth charts) in the context of glaring deficiencies in their infrastructures, suffers from too many imperfections and inaccuracies to be considered satisfactory and reliable. Unless minimal requirements for proper growth-monitoring namely—(1) the regular supply of good quality scales, (2) facilities for their frequent calibration, repair and replacement, (3) facilities for transport of scales to ensure their availability in *adequate* numbers at the sites of action, (4) methods to ensure accuracy of weight measurements and age verification, (5) growth charts and health cards in adequate numbers, (6) training of workers in accurate plotting of weight data and their proper interpretation, (7) *most importantly*, facilities for prompt follow-up action

indicated by growth data; (8) facilities for supportive supervision, and frequent evaluation, (9) facilities for collation of growth data for monitoring child health trends at the national level,—are available or can be organised within the country's resources, it will be unwise to embark on growth-monitoring as a national public-health activity using foreign support which may be available initially but will be certainly withdrawn with time. Since most developing countries cannot command these facilities, without very significant augmentation of their current health budgets, the question of evolving less expensive and more feasible models of growth-monitoring which developing countries can adopt and carry out with the means and resources at their disposal arises.

Our effort must be to see how growth-monitoring technology can be adapted to these real-life conditions in the poor developing countries rather than to explore how the health systems of developing countries can be adapted to wholly incorporate a given technology in any preconceived form (“preconceived” either in the ‘armchairs’ or laboratories of developed countries, or in small-scale field projects with artificial inputs which bear no relationship to larger-scale realities). It is often said that Man invents a technology and, for a time, imagines himself as its Master, but he soon ends up as its slave. We should not allow this to happen with growth-monitoring; precisely because it is useful, and if wisely employed, taking note of actual field conditions, can make a substantial contribution to the promotion of health and nutrition in developing countries. Agencies which are promoting growth-monitoring programmes in developing countries should ensure that the facilities for following up growth-monitoring by appropriate action are available in the country or developed side by side with the growth-monitoring effort. They must also ensure that the country concerned will be able to sustain the operation with its own resources.

The choice of the technology for growth-monitoring and the strategy for its use will depend heavily on the level of development of the health system of a given country. There can be no uniform model applicable to all countries. Indeed, even within a country, different models suitable for different regions may be employed.

Few developing countries have the health infrastructure to organise and satisfactorily conduct regular weighing and growth charting on “Road-to-Health” cards through visits to individual homes. At present, growth-monitoring programmes in most developing countries are in fact being carried out at health centres, *anganwadis* (as in the ICDS programme in India), or at *melas* (periodic congregations in a village square). Cowan's programme in Ludhiana is a home-

based operation, and she is apparently able to operate the programme successfully with minimal additional inputs through adopting a strategy of effective deployment of available manpower, and by identifying “difficult homes” and concentrating attention on them. The success of this model must be largely attributed to the dedicated leadership, supportive supervision, and the backing of a medical college with high traditions in the field of community medicine. These latter inputs defy costing. This model, like many other small-scale ones, under similar leadership (Arole’s for example) may not be replicable on a country-wide scale. At best, they may be capable of replication in rural ‘blocks’ adjoining other medical colleges in the country, provided the Departments of Community Medicine of those colleges are prepared and motivated enough to organise and supervise the programme, thus providing the same invaluable inputs as those in the programme reported by Cowan. Models of this kind, despite their lack of replicability, help to provide valuable insights and could serve as training grounds for health personnel, not just in growth-monitoring but in child health and nutrition programmes in the field.

A careful and detailed consideration of the available global experience in the use of growth charts leads us to question the wisdom of introducing elaborate weighing and growth charting operations *at the village and home levels*. The strategy of saddling village level workers with the responsibility of carrying weighing scales to homes or to village squares, and of charting growth data on “Road-to-Health” cards, clearly does not produce results commensurate with the time, energy and resources spent. Such a strategy may prove counter-productive. The several deficiencies and constraints observed are unlikely to be easily remedied.

Indeed, even the necessity for such a complicated and sophisticated operation at the village or home level of primary health care is questionable. There is currently no evidence that the elaborate use of growth chart *per se* has done much to improve the nutritional status of children. Even Cowan, who has shown good results in her programme, is unable to say whether there results are attributable to the growth charts *per se* or to other components of the health services which are offered (44). Srilatha, on the other hand, is clear that growth charting has not been of much help within RUHSA’s overall health strategy (52).

Growth-monitoring need not necessarily always imply plotting growth data on “Road-to-Health” charts. Developing countries should boldly strike out their own paths, perhaps using simplified and much less expensive procedures, depending on the capabilities of their specific health system.

6.4. A STRATEGY FOR ACTION

Taking all these considerations into account, it may be concluded that the strategy of individual surveillance of all under-fives in a country with periodic weighing and growth charting is wholly unrealistic and indeed unnecessary. Instead, we propose that the following strategy for growth-monitoring may be more feasible and "cost effective".

(1) Home-based monitoring: At the home level, mid-arm circumference measurement could replace weighing and growth charts. The measurement of mid-arm circumference is a simpler, less cumbersome, less time-consuming, and *very much less expensive* procedure. While the Salter scales cost around \$35 each, the arm-strips would cost just less than five cents if produced locally. The strips can be fabricated indigenously in practically all developing countries and need not be imported. Taking the MAC measurement and its recording on a card will require one-tenth of the time for weight measurement and growth charting. There are no major transport, upkeep, and repair problems associated with the "instrument". There will be no problems of "hanging" the device. The measurement technique can be much more easily taught to health workers, mothers and school children. Children and mothers will be much less "scared" and in the home the health worker will have more time for interaction with the mother instead of being 'weighed down' by the elaborate weighing and charting process. The 'noise level' will be low enough to permit meaningful and relaxed counselling.

It may be argued that this technique is not as sensitive as weight recording but the balance of advantage in large-scale field operations may still lie in using this simpler, less sophisticated device. The 'precision' and sensitivity of this approach can be enhanced if, in addition to the colour zones on the strip, the strip is also graduated in centimetres to show the actual measurement. This would enable the worker to assess periodic changes within a colour zone. Periodic measurements (every one or two months depending on the child's age) can be recorded in a register and yet be 'interpreted' meaningfully, unlike weight measurements which require the difficult plotting procedure and separate weight charts.

The strips currently in use may require redesigning. For example, the one used in the ICDS programme is confusing, as one cannot distinguish the "head" from the "tail". A strip with a slightly broader "head" and a transverse slit which

also indicates the starting point of measurement, through which the tail of the strip can be passed after encircling the arm will be appropriate.

Another drawback of the existing device is that it cannot be used for infants. But this may be overcome if the strip designed by Echeverri specifically for infants is used. This latter device needs further validation to establish the appropriate "cut-off points". After such modifications as seem necessary are made, and if further studies do show that the device with appropriate modifications is in fact suitable, it could be usefully employed. This will greatly simplify growth-monitoring at the home level.

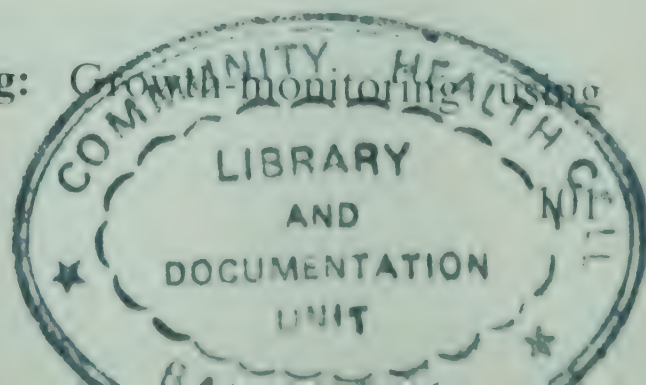
Ongoing studies attempting to correlate changes in arm circumference measurements with changes in body weight will provide data which will help to offset some of the current deficiencies of this approach (75). There may not be strict correspondence between MAC and weight measurements with respect to their ability to identify children 'at risk'. However, lack of such correspondence need not be construed as an argument against the use of the MAC measurement because the validity of cut-off points being used to identify 'at risk' children using the weight-for-age criterion is equally open to question. In both systems, we are lying on arbitrary cut-off points which cannot be justified on rigid scientific grounds but only on practical considerations of programme management in the context of available resources. Some studies suggest the MAC tends to "capture" more at-risk children than currently used weight-for-age standards. If this be the case, it will add to the merit of MAC since, in the strategy being advocated, it is conceived as part of a "first-order" of basic health care designed for quick and early detection of growth faltering. Procedures which help to further, refine and enhance the validity of mid-arm circumference measurements will be of great advantage, and field research in this area is of high priority.

In suggesting the replacement of the present growth charts by mid-arm circumference measures at the home and village levels, we are *not* suggesting that Child Health Cards which provide other useful information are to be done away with. Our recommendation implies that the growth chart in the present health card may be replaced by an appropriately-designed space to record mid-arm circumference measurements (in cms.) — not just the colour zone — at regular intervals. Instructions on the use of the arm band and the criteria for referral to clinics (see below) could also be printed on the health card.

(2) Clinic/Centre-based growth-monitoring: Growth-monitoring using

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weighing and growth charts could be confined to clinics or "sub-centres" or special child-welfare centres like the *aganwadis* where adequate facilities for the successful conduct of this operation and for its meaningful follow-up are provided. Workers employed for this purpose at these clinics/sub-centres must be adequately trained and must have the benefit of supportive supervision. The growth charts filled by them must be periodically checked to detect any errors.

These clinics/sub-centres should *not* attempt individual surveillance (using weighing and growth charts) of all children in the communities. Only those children who are identified as requiring investigation and further care on the basis of their mid-arm circumference measurement taken during home-based monitoring by village level workers or at the clinic itself should be taken up for weighing and growth charting. This will be a "second order" of growth-monitoring. Referral of these cases to the clinic is not necessarily based on the consideration that weight measurement is a better indicator of nutritional status than mid-arm circumference measurement. Referral is mainly suggested for purposes of (a) verification of growth retardation with an alternative technology, and (b) for advice and counselling of a better order which is expected to be available at the clinic/centre where workers of a higher level of training function. It is not also necessary that all children showing less than 13.5 cm. or 12.5 cm. arm circumference during home-based monitoring should be automatically referred to clinic/centre. A good proportion of these children could be handled successfully by the counselling of mothers by health-workers at the home level itself.

This arrangement will greatly reduce the time spent on growth-monitoring at clinics, leaving time for actual follow-up and management. There will be no need for the "four table arrangement" followed currently in the UPGK programme in Indonesia. This will greatly cut down on the need for workers and volunteers and reduce the noise level and crowding in the clinics. The same health worker can do the weighing, charting and counselling. Weight-monitoring under these circumstances is likely to be far more accurate and valid. Workers will not be "swamped" to a deluge of charts, many of which are unreliable. Through this arrangement, the number of scales needed and the number of health-worker-hours spent on growth-monitoring alone will be drastically reduced. The appropriate balance between "diagnosis" and "treatment" will thus be restored. The emphasis in the clinics will be on actual services.

The ICDS programme in India, after considerable trial and error, now proposes to follow a strategy of initial screening of children by mid-arm

circumference measurement, and restriction of weighing and growth charting to those identified as needing special attention on the basis of such screening. This strategy has been arrived at on the basis of considerable practical experience with, and lessons learnt from, the earlier ambitious programme aimed at weighing and growth charting of all children (72).

Nutrition supplements: In many growth-monitoring programmes, nutrition supplements are generally offered to attract poor children. We need not object to this approach as long as the feeding is actually conducted as an educational operation for demonstration of appropriate methods of infant feeding used on local foods, and not just as a charity feeding exercise. Imaginative programmes of nutrition education can be built around supplementary feeding. But, for this purpose, the food supplements must be based on locally available, inexpensive foods and not on donated, processed food formulations, totally alien to the people.

In the ICDS programme in India, the food supplement is offered to all children who happen to be present at the centre at the time, and not just to the 'identified' children only; (the severely undernourished get twice the ration). Since, in any case, not all identified beneficiaries turn up regularly, in actual practice, this arrangement does not impose greater demands than would be the case if supplements were distributed only to selected beneficiaries with unfailing regularity. As a result, the feeding operation, though originally conceived as a rehabilitatory measure, has in practice become a tool for education of mothers and community and for inducing mothers to turn up at centres for immunisation and other health services. This arrangement is not more wasteful than the operation as originally conceived because, it must be remembered, that practically all children turning up at these centres are drawn from poor communities and suffer varying degrees of undernutrition, though some of them may not pass the "severity test" at a given point of time. We certainly do not suggest that supplementary feeding be taken up at all clinics/centres. But if resources are forthcoming for limited feeding programmes, it may be wiser to use them as a tool for a well-conceived programme of education of the community on correct child feeding practices than as mainly a repair/rehabilitation operation.

The merit of the foregoing strategy: The strategy proposed here represents an *advance* over the present situation in two important respects.

(a) At present, the emphasis appears to be on the quantitative aspect —

namely the extent of coverage irrespective of the competence of the infrastructure and available resources to the neglect of the quality and reliability of growth-monitoring to the point of missing its essential purpose. The present strategy is an attempt to shift the emphasis to the *quality consideration*.

(b) At present most growth-monitoring operations are being carried out as either special programmes or as *ad hoc* projects (UPGK in Indonesia and Tamil Nadu Integrated Nutrition Project in India) outside the Health System. The present strategy seeks to provide for growth-monitoring a meaningful place *within the health system*, without detriment to the other components of that system and without introducing undue imbalances into them. The present strategy provides for two "orders" of growth-monitoring, the first order being home-based and utilising simple technology, and the second order in clinics/centres using more complicated and sophisticated technology. With this arrangement, the health workers at the clinics/centres will also not be swamped by weighing and charting activity to the detriment of other essential duties. Growth-monitoring using growth charts will gain accuracy and will be more meaningful related to education and follow-up activity. We see, in the long run, far greater possibilities of the strategy we propose finding a durable place in the health programmes of developing countries than some of the more ambitious projects now being attempted.

The strategy suggested here is not without its limitations. Firstly, *with respect to infants*, we are still not sure that mid-arm circumference measurement will prove satisfactory even for the purpose of initial screening and for early detection of growth faltering. We need further research on this subject. Till such time as we are on firm ground, on this point, it may be prudent for the health worker not to rely on mid-arm circumference measure only as far as infants are concerned, but to advise their mothers to visit the nearest clinic/centre to get their infants periodically weighed. Since infants will roughly constitute only around one fourth of under-fives population in a village, this arrangement need not involve heavy work-load on the health worker or the clinic. In any case, infants have to be taken to the clinic-centre for immunisation and with an efficient health worker, it should not be impossible to persuade them to make a few more visits during the year.

Secondly, the great drawback of clinic based growth-monitoring has been that needy children often fail to turn up. However, in the strategy proposed here, the number of children that need go to a clinic/centre for weight recording and growth charting will be very small as compared to the numbers that would have been involved if weighing and growth-charting of all under-fives was attempted.

Because of the small numbers involved, it should be possible for the health worker to focus her special attention on the children identified by her as being at risk on the basis of her home-based arm circumference measurement; and to persuade their mothers to take them regularly to the clinic/centre for weight measurements. Thus a satisfactory coverage of the needy children could be achieved. Further, if, as we are suggesting in the following page, rural schools could function as health posts over week-ends with the trained staff of clinics/centres in attendance, easier accessibility and even better coverage will be assured.

(3) The use of the rural school system: A major objection to the strategy of limiting weighing and growth charts to clinics/sub-centres could be that these centres are often inaccessible and the “distance consideration” may act as a disincentive to mothers to visit clinics. In order to overcome this, we suggest that the rural school could be used as a health post. The argument for the use of the rural school as a health-post rests on far more important grounds than the distance consideration referred to above.

Rural schools systems in developing countries offer attractive possibilities not only for growth-monitoring of children, but for promotion of health and nutrition programmes among communities. In India, for example, there are presently 431,602 rural primary schools scattered over the country. The location of the schools is such that practically every village has a school within a distance of one km. These schools could very well serve as “health posts” wherefrom, with minimal inputs and with the interaction of health staff from health centres and school teachers, meaningful health promotion programmes could be organised. This aspect has been considered in some detail in a separate publication, and a programme for the use of rural schools for community health and nutrition education through school-community interaction has been outlined (90). The enlistment of the rural school system for health promotion activities will greatly enhance the rural outreach of health systems of developing countries without much additional investment. It will also significantly augment the manpower resources since teachers and pupils of higher classes can in fact offer considerable help in health promotion programmes including growth-monitoring programmes. In the school syllabus and in the time-tables, provision is made for what is called “socially-productive work”. No work could better qualify for this description than health-promotion programmes. The education of older pupils in schools on the importance of adequate diets for growth and development, and on simple methods of growth measurement of children will prove to be most rewarding. Children can be taught and trained to weigh themselves and to take an interest in changes in their own weights over a period of time. (This operation will not need the expensive Salter scales but could be

organised with much less expensive indigenously fabricated 'bath-room' type of scales.) The presence of an older sibling in the family who understands the significance of proper growth and its relation to diet and nutrition will greatly facilitate the interactions of the health worker with the mother. Through such reinforcement, community health-nutrition education programmes could be greatly strengthened. The pupils themselves will be better educated, they will get a better understanding of measurements, of the use of graphs and of the biological implications of growth and nutrition.

The arrangement we suggest is that rural schools could become 'health posts' at specific times when parent-teacher meetings would take place. At these meetings, health workers from the clinic/centre could be present to offer health services including weighing of (pre-school) children from the village referred on the basis of earlier home based growth-monitoring and chart their growth performance. The emphasis at these meetings, however, will be on education and services and not on the weighing activity which will be restricted only to those children referred after home-based screening, and infants. At present, the enormous potential offered by the rural school system is not being utilised and the educational system and the health system at the rural level are operating in isolation. Forging of functional linkages between the systems will mutually reinforce them and, on the one hand, make education socially relevant, and on the other hand, improve the outreach of rural health services.

(4) Enlistment of future home-makers: A great deal has been said about the involvement and motivation of mothers. An even more rewarding approach would be the enlistment of the "future home-makers", young women who are just on the threshold of marriage and motherhood. A proposal for involving this most valuable group in health and nutrition programmes and development activities has been presented in an earlier publication (91). A special, board-based programme of "education for better living" aimed at young women between 12-20 years has been proposed. Care in pregnancy and lactation, care of the new-born, infant feeding and rearing, child care and development, immunisation, care of diarrhoeas etc., are all part of the proposed programme of education. Training in simple techniques of growth-monitoring could easily be included in the training in mothercraft and child rearing. Since the details of this proposal have been presented elsewhere, they are not discussed further here. It is to be hoped that, through participation in such education, the next generation of children will not need the help of an elaborate state-sponsored, growth-monitoring programme to ensure their nutritional status — that mothers themselves would be sufficiently competent and motivated to undertake this work and to demand and utilise health services.

(5) The role of medical education and research institutions: Medical Colleges and health research institutes in developing countries could carry out from time to time cross-sectional studies of growth of children using weight, height and arm measurements along with diet and nutrition surveys in order to obtain further insights into the relationship between diet, nutritional status and anthropometric indices, and the inter-relationship between these different measures and their relative merits as indicators of undernutrition. These studies will also help the identification of severely undernourished communities in the population which stand in need of intervention in the form of supplementary feeding. Feeding programmes could be targeted to children of such groups without the need for parallel growth-monitoring operations. Data collected from different regional surveys through such studies could be periodically collated for purposes of national health and nutrition planning and could provide an indication of changing trends in nutritional status of children. In this way, national data needs can be met without continual, laborious, growth-monitoring procedures and without competing with the far more important task of providing individual child health and nutrition care.

7. Summary

1) Growth-monitoring is a useful measure which can significantly contribute to the promotion of child health and nutrition. In this study, a critical review of the global experience in the use of growth charts has been attempted. The review is based on published and unpublished reports, consultations and correspondence with health and nutrition workers in different parts of the world and on actual field studies as well.

2) The technology for growth-monitoring that is being most widely promoted is that of weighing and charting serial weight-for-age readings. The successful application of this technology, however, calls for certain essential requisites. In many ongoing growth-monitoring programmes in developing countries which use this technology, it would appear that these basic requisites are currently not being adequately fulfilled. In such situations, growth-monitoring may be generating a lot of inaccurate and unreliable data, and may not be followed by appropriate remedial action.

3) There are many logistic problems and deficiencies in the weighing procedure and use of growth charts. These start with the procurement of weighing scales, their transport and servicing. There are also deficiencies in the taking of weights, recording and charting of growth data by health workers. The greatest difficulties appear to be with respect to interpretation of growth data and with the institution of follow-up health action.

4) Growth-monitoring is no more than a diagnostic technology. It is not an end in itself. It can be justified only if it leads to positive action, resulting in improvement in child health and nutrition. The major concern in most ongoing growth-monitoring programmes currently appears to be with the mechanics of

weighing and charting, and with the achievement of "wide coverage". Such excessive preoccupation with the mechanics of weighing and charting without corresponding attempts to interpret the findings and initiate appropriate action tends to reduce these operations into formal weighing rituals.

5) A review of some ongoing growth-monitoring programmes using weighing and growth charting techniques suggest that these programmes have been initiated at great cost, without adequate preparation and training of the health workers, and without adequate attention to the basic requisites for proper monitoring and, more importantly, for follow-up. The cost factor in relation to the total health budget of the concerned developing country has rarely been given adequate consideration. That growth-monitoring is only a part of an integrated system and will be wholly futile if other parts of the system are nonexistent or inadequate, has not been fully recognised. Before any developing country undertakes growth-monitoring using the expensive technology being advocated, it is important to ensure that the basic requisites for a complete and meaningful operation are on the ground. Otherwise, expenditure incurred will be infructuous. The over-enthusiastic promotion of growth-monitoring techniques involving weight measurement and growth charts in situations where the basic requisite infrastructure for such operations does not exist could well result in a backlash of disillusionment with growth-monitoring *per se*. This would be most unfortunate because simplified and properly executed growth-monitoring can pay important dividends for child health. Agencies which support growth-monitoring operations in developing countries should be equally ready to provide support to facilities for follow-up action. More importantly, they should be building up indigenous expertise which will make growth-monitoring possible within national resources. Otherwise, 'growth-monitoring' will languish when external support is withdrawn.

6) Growth-monitoring has two major objectives — (1) the early identification of growth faltering and (2) the facilitation of health worker-mother interactions and nutrition education. At present, these two objectives do not appear to be receiving adequate focus. The major concern in growth-monitoring operations at present seems to be the identification of "beneficiaries" for supplementary feeding operations — the beneficiaries generally being those in severe grades of undernutrition. This strategy is questionable. Growth-monitoring should not be a mere adjunct of operations aimed at "child survival", but should be part of a broader strategy aimed at promotion of child health/nutrition. For this purpose, the emphasis must shift to early detection of growth faltering. The objective of educating mother seems to have been largely lost sight of, possibly because time-consuming weighing and charting procedures leave little time for relaxed interaction between health workers and mothers. While

training and motivation of workers in the technique of growth-monitoring is emphasised, emphasis on training in nutrition education — with respect to content and methodology — is lacking. The result is that most health workers do not really know what to do with their growth data.

7) At present, growth-monitoring using weighing and growth charts is being undertaken largely in special programmes and has not become part of the regular agenda of the health systems of most developing countries. The inputs in some of these special programmes are so high that their replicability on a country-wide scale and on a long-term basis appears doubtful. Currently most of these programmes are being sustained through substantial foreign support, raising the question of what might happen when such external support is withdrawn. The important consideration that a programme's scale and technology must be adapted to suit local requirements and capabilities has not received sufficient attention.

8) Growth-monitoring using weighing and growth charts has been successfully carried out in some small-scale projects with dedicated leadership and supervision. But these models may not be capable of replication in large-scale governmental health systems. The health systems of developing countries are at various levels of 'development'. A rigid uniform pattern of growth-monitoring should not be advocated for all countries. The pattern must be adapted to suit local capabilities. Elaborate weighing and charting on "Road-to-Health" cards may not be possible in all situations. Indeed, they may not even be necessary. Less complicated, less cumbersome, and less time-consuming technologies could be adopted in situations where the health infrastructure is relatively weak. Even if these adaptations are less sensitive, the overall results from their use may be better. Proper use of "less sensitive" procedure may yield more reliable data than improper use of "more sophisticated" techniques. Furthermore, the criterion of success at present seems to be the quantitative and not the qualitative dimension. Too much obsession with the *extent* of coverage to the relative neglect of *quality* of coverage will do child health and nutrition no good.

9) The cost factor is also important. The estimated cost of some of the ongoing growth-monitoring operations using weighing and growth charts in developing countries (which may initially be partially defrayed by assistance from international and bilateral sources) constitutes a high proportion of their overall national health budgets. Such 'unreal' exercises can have no future. This consideration underscores the need for 'adaptation' and 'simplification' of growth-monitoring procedures.

10) On the basis of these considerations, a strategy of growth-monitoring which may be appropriate to developing countries has been suggested in this report. The objective of individual surveillance of all under-fives in the country with weighing and growth charting seems unrealistic and unnecessary. It seems advisable *not* to promote a growth-monitoring technique which involves frequent weighing and growth charts at the village or home levels. Instead, the technique of mid-arm circumference measurement may replace weighing and growth charts at the home and village level. This has the advantages of being potentially within the competence of and resources of the health systems of developing countries.

11) Growth-monitoring using weighing and growth charts would be appropriately carried out at clinics and sub-centres where special facilities and trained staff are provided. Proper facilities must be provided at this level not only for growth-monitoring but for follow-up services. At these centres the objective should not be individual surveillance of all children, but follow-up of cases identified as 'at risk' at the home level by use of mid-arm circumference measurements and referred to these centres for special attention.

12) The enlistment of the rural school system for preventive and promotive community health and nutrition activities may prove rewarding. The school system has some obvious advantages which should be exploited for the promotion of child health/nutrition programme. Rural schools could become health posts at which parents, teachers and health workers interact and health education and health services are provided. Growth-monitoring in selected children using growth charts can be carried out by health staff with the help of senior school children so that ultimately education and health objectives are mutually reinforcing.

13) The real key to child health in developing countries lies in the promotion of female education. A programme of "education for better living" has been suggested as a possible model for educating young women on the threshold of marriage and motherhood in the essentials of child health and nutrition. Training in simple techniques of growth-monitoring could very well form part of such education.

14) The foregoing narration of the current deficiencies in growth-monitoring and the criticisms should not obscure the fact that growth-monitoring programmes have provided a new focus on the nutrition problems of children in developing countries. They have imparted a new impetus to "nutrition

movements" in these countries. Nutrition has occupied a 'back seat' in the health systems of developing countries for far too long. Growth-monitoring, if conducted on the right lines and with the appropriate, simple technology, could well provide the means for correcting this unfortunate situation. On the other hand, time-consuming, complicated and expensive technologies, far beyond the resources of developing countries, will be counterproductive. The deficiencies pointed out in this Report should not be construed as arguments against growth-monitoring, but rather as arguments *in favour of promoting and strengthening growth-monitoring operations on the right lines so that their true objectives are realised.*

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9. Appendices

9.1. APPENDIX I — SCIENTISTS CONSULTED

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- 2) Alan Berg, The World Bank, Washington D.C., U.S.A.
- 3) D.K. Agarwal, Department of Pediatrics, Institute of Medical Sciences, Banaras Hindu University, Varanasi, India.
- 4) Mary Ann Anderon, U.S. Agency for International Development, New Delhi, India.
- 5) R.S. Arole, Comprehensive Rural Health Project, Jamkhed, Maharashtra, India.
- 6) K.V. Baily, Joint FAO/WHO/OAU Regional Food and Nutrition Commission for Africa, Accra, Ghana.
- 7) Meera Chatterjee, Centre for Policy Research, New Delhi, India.
- 8) S.N. Chaudhuri, Child-in-Need Institute, Calcutta, India.
- 9) Adolfo Chavez, Institute Nacional de la Nutricion, Salvador, Mexico.
- 10) Lincoln Chen, Ford Foundation, New Delhi, India.
- 11) Robert Cook, MCH Unit, WHO, Geneva, Switzerland.
- 12) Betty Cowan, Christian Medical College, Ludhiana, India.
- 13) Sakorn Dhanamitta, Ramathibodi Hospital, Faculty of Medicine, Bangkok, Thailand.
- 14) Silvestre Frenk, Centro Medico Nacional, Mexico City, Mexico.
- 15) M.K. Gabr, Department of Pediatrics, University of Cairo, Egypt.
- 16) Tara Gopaldas, Faculty of Home Sciences, M.S. University, Baroda, Gujarat, India.
- 17) James A. Greene, World Bank, Washington, D.C., U.S.A.
- 18) Jean-Pierre Habicht, Cornell University, Division of Nutritional Sciences, Ithaca, New York, U.S.A.

- 19) Yngve Hofvander, Department of Pediatrics, University Hospital, Uppsala, Sweden.
- 20) G. Ibrahim, Institute of Child Health, London, U.K.
- 21) D.B. Jelliffe, School of Public Health, University of California, Los Angeles, U.S.A.
- 22) Mary Johnston, Yayasan Indonesia Sejahtara (YIS), Solo, Indonesia.
- 23) Abraham Joseph, Department of Community Health, Christian Medical College, Vellore, Tamil Nadu, India.
- 24) D. Karyadi, Department of Kesehatan R.I., Bogor, Indonesia.
- 25) K.K. Kaul, Department of Pediatrics, Medical College, Jabalpur, India.
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- 28) Miguel D. Lopez, Social Science Research Division, Nutrition Center of the Philippines, Manila, Philippines.
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- 30) David Morley, Institute of Child Health, London, U.K.
- 31) W. Henry Mosley, Ford Foundation, Jakarta, Indonesia.
- 32) Daleep Mukherjee, Rural Unit for Health & Social Affairs, Tamil Nadu, India.
- 33) David Nabarro, Save The Children Fund, Kathmandu, Nepal.
- 34) Vijayakrishnan Nair, Nutrition Adviser, WHO, Western Pacific Region, Manila, Philippines.
- 35) Comlan A.A. Quenum, Regional Director, WHO Regional Office for Africa, Brazzaville, Congo.
- 36) Ch. Randriamanana, Regional Officer, WHO, Regional Office for Africa, Brazzaville, Congo.
- 37) N. Prahlada Rao, Deputy Director, National Institute of Nutrition, Hyderabad, India.
- 38) K.S. Rao, Former Director, Division of Nutrition and Public Health, WHO, Eastern Mediterranean Regional Office, Alexandria, Egypt.
- 39) P.S.S. Sundar Rao, Christian Medical College, Vellore, Tamil Nadu, India.
- 40) Jon E. Rohde, Management Science for Health, Port-Au-Prince, Haiti.
- 41) Florentino Solon, Nutrition Centre of the Philippines, Manila Philippines.
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9.2. PARTICIPANTS IN THE CONSULTATION MEETING

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